A McGRAW-HILL ELECTRONICS PUBLICATION AUGUST 20, 1984 $3

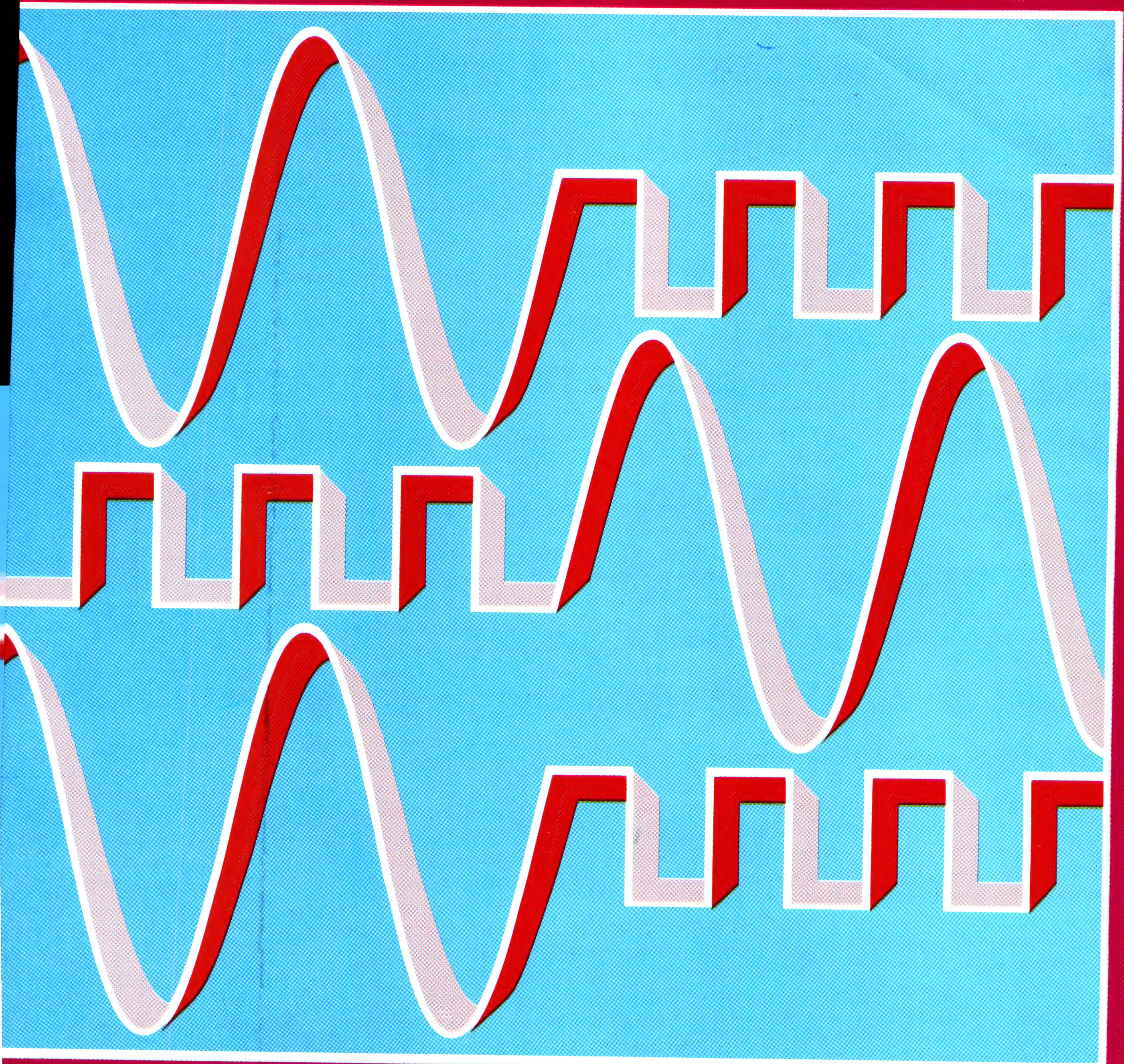
# ElectronicsWeek®

3 AUG RECD

**New world for users of Ethernet**

**ACCESS TO IBM MACHINES/77**

## DATA CONVERSION SHARPENS ITS ACT/63



U.S. agriculture signs on some new farmhands: robots/30

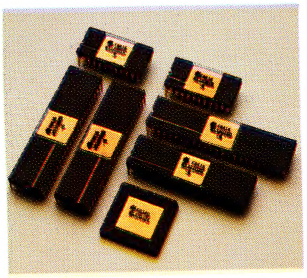
Optical-disk technologies will be whirling strongly by year-end/19

Software tools automate structured analysis/69

# National's Series 32000.™

**National's Series 32000™ (formerly known as NS16000) provides the most complete family of 32-bit CPUs, slave processors, systems peripherals, development systems and software. Today!**

In today's fast paced high-technology marketplace, time equals money. And chances for product success often depend upon narrow windows of opportunity. So time-to-market becomes a critical ingredient in microprocessor selection.



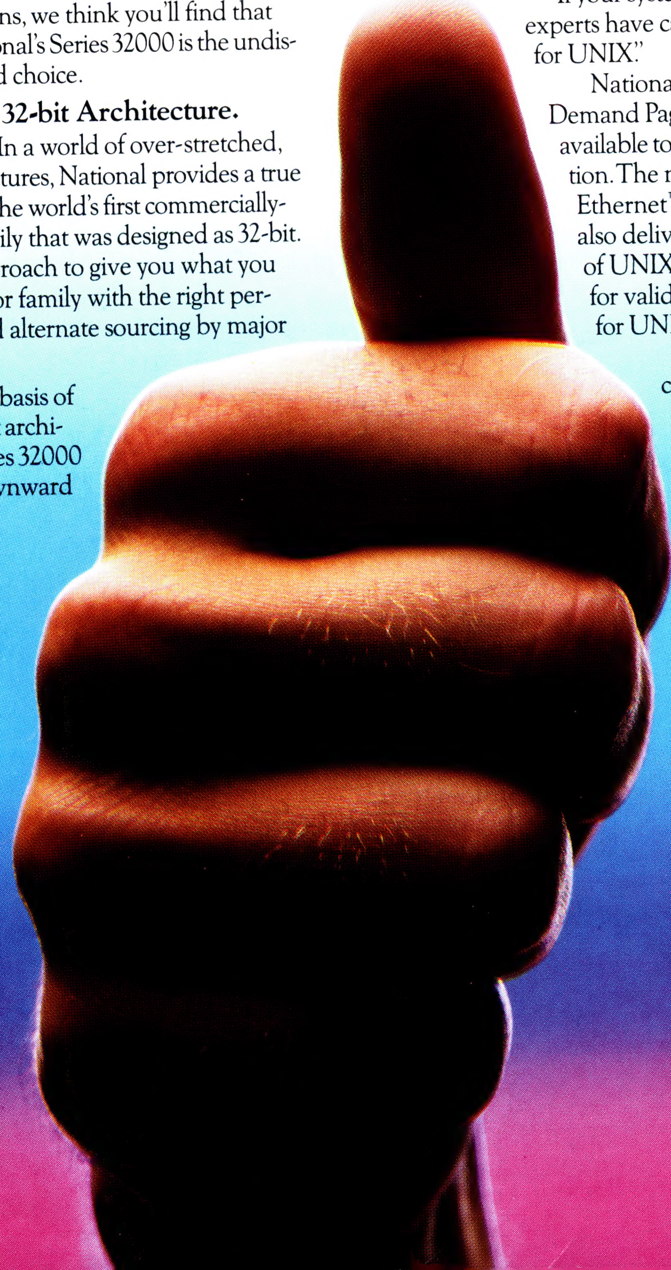
When you thoroughly evaluate and compare available 32-bit options, we think you'll find that National's Series 32000 is the undisputed choice.

## Full 32-bit Architecture.

In a world of over-stretched, band-aided microprocessor architectures, National provides a true 32-bit solution. The Series 32000 is the world's first commercially-available 32-bit microprocessor family that was designed as 32-bit. We've taken a systems solution approach to give you what you need: An innovative microprocessor family with the right performance. Current availability. And alternate sourcing by major manufacturers.

- *Advanced 32-bit architecture* is the basis of the Series 32000. This same 32-bit architecture is implemented in all Series 32000 CPUs. These CPUs also offer downward compatibility in 16 and 8-bit external data bus versions.
- *Fast floating point support* is available now with National's NS 32081, the *only* viable floating point unit to support your system's needs for floating point operations.
- *A powerful MMU, National's NS 32082, provides Demand Paged Virtual Memory support* and it's available today. This industry 'first' provides fast on-chip address translation and advanced operating systems support, making it the ideal choice for a UNIX™ environment.

## The best UNIX Micro.



If your system design calls for UNIX, industry experts have called the Series 32000 "the best for UNIX."

National's GENIX,™ featuring optimized Demand Paged Virtual Memory support, is available today in source form for OEM adaptation. The next generation of GENIX, with Ethernet™ support, is in test now. We have also delivered the Series 32000 version of UNIX System V (release 2.0) to AT&T for validation. National is your source for UNIX.

Our Series 32000 software catalog gives OEMs an opportunity to select from a wide variety of software, including offerings from independent software vendors.

you can wait for somebody else's.

# You can get our complete 32-bit microprocessor family today. Or...

# The 32-bit solution. We've got it!

**Series 32000 is the only 32-bit solution today.**

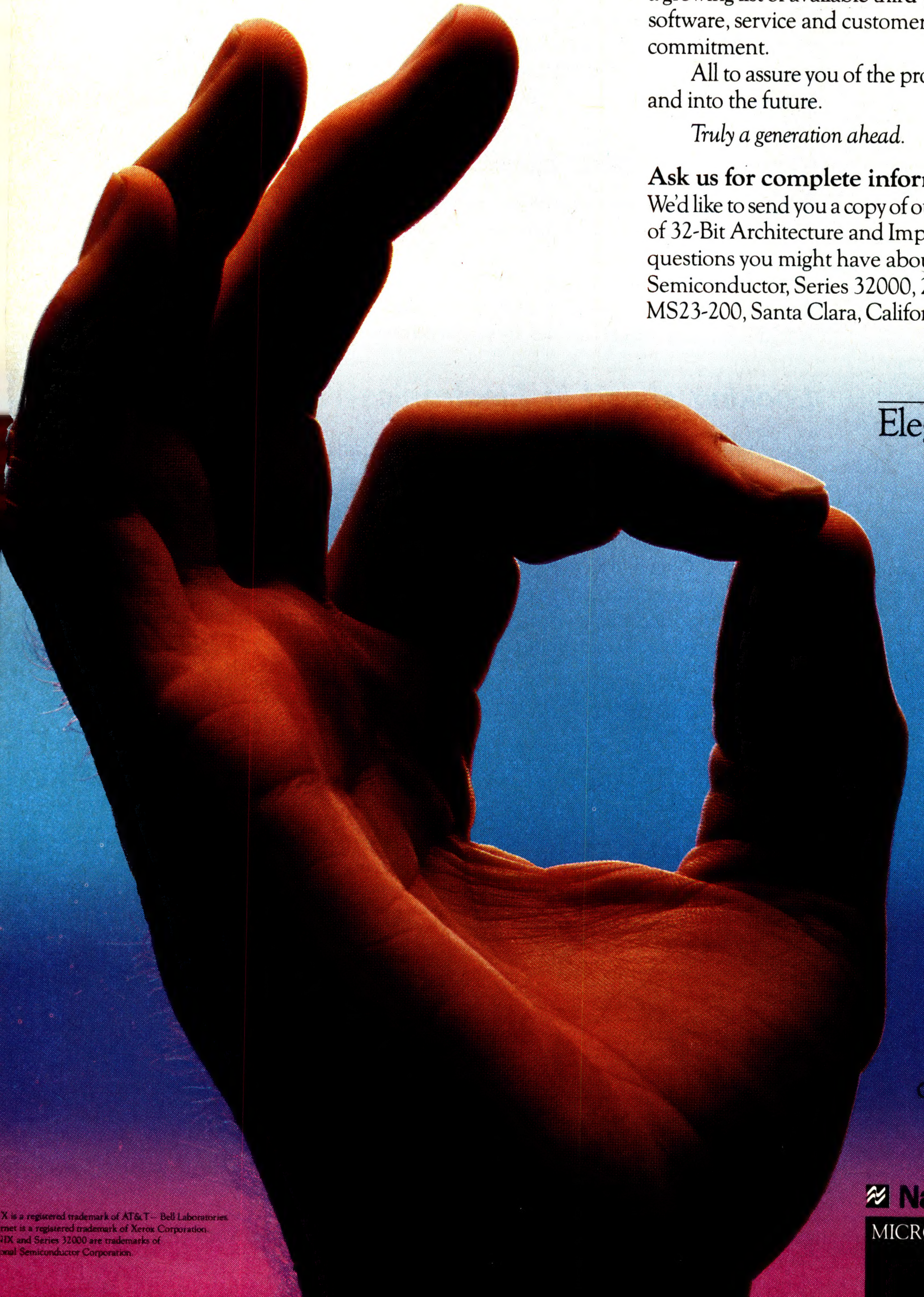
If your market window falls within the next twenty-four months, the Series 32000 provides you with product for your designs *today*. National is the only manufacturer that offers a complete 32-bit microprocessor family now. With an architecture designed to fully support high-level languages; a full 32-bit data bus to memory that increases memory bus bandwidth and thus the speed at which data can be transferred; a range of CPUs with total compatibility to 16 and 8-bit; a full range of peripherals; powerful evaluation tools; a multi-user, multi-tasking development system; a growing list of available third-party software; and the hardware, software, service and customer training that spell real long-range commitment.

All to assure you of the products and support you need *today* and into the future.

*Truly a generation ahead.*

**Ask us for complete information.**
We'd like to send you a copy of our brochure entitled: "The Specifics of 32-Bit Architecture and Implementation." And to answer any questions you might have about Series 32000. Write to National Semiconductor, Series 32000, 2900 Semiconductor Drive, MS23-200, Santa Clara, California 95051.

**Series 32000.**
Elegance is everything.



Circle 1 on reader service card

**National Semiconductor**
MICROCOMPUTER SYSTEMS DIVISION.

X is a registered trademark of AT&T— Bell Laboratories.
rnet is a registered trademark of Xerox Corporation.
IIX and Series 32000 are trademarks of
onal Semiconductor Corporation.

# ElectronicsWeek

**PREVIEWS**

EDITOR IN CHIEF: George R. Davis

EXECUTIVE EDITOR, *technical:* Samuel Weber
EXECUTIVE EDITOR, *news:* Arthur Erikson
MANAGING EDITOR: Howard Wolff

SENIOR EDITORS:
Howard Bierman, Ray Connolly,
Tom Manuel, Kevin Smith, Jeremy Young

ART DIRECTOR: Fred Sklenar

DEPARTMENTS
*Business:* Robert J. Kozma
*Communications & Microwave:*
Terry Feldt
*Components:* Ashok Bindra
*Computers & Peripherals:* Tom Manuel
*Government/Military:* Ray Connolly
*Industrial & Consumer:* David M. Weber
*New Products:* Steve Zollo,
Steve Haggerty
*Packaging & Production:* Jerry Lyman
*Semiconductors:* Samuel Weber
*Software & Microsystems:*
Jeremy Young
*Systems Integration:* Robert Rosenberg
*Test & Measurement:* Howard Bierman

NEWS EDITORS
Robert J. Kozma, Jesse J. Leaf,
David M. Weber

EDITORIAL PRODUCTION
Charles D. Ciatto, *Manager,* June Noto,
Jody LoGrasso, Kevin J. Powers

COPY DESK
Benjamin A. Mason, *Assistant Managing Editor,* Jay J. Iorio, Bill McIlvaine,
Jim Taibi, Susan Levi Wallach

ART DEPARTMENT
Sachiko Inagaki, *Associate Director*
Kathleen Mulderrig, Annamaria Palma,
*Art Assistants*

NEWS BUREAUS
*Boston:* Craig D. Rose
*Chicago:* Wesley R. Iversen
*Dallas:* J. Robert Lineback
*Los Angeles:* Larry Waller
*New York:* George Leopold
*Palo Alto:* Clifford Barney
*Washington:* Ray Connolly, Karen Berney
*Frankfurt:* John Gosch
*London:* Kevin Smith
*Paris:* Robert T. Gallagher
*Tokyo:* Charles L. Cohen, Michael Berger

ADMINISTRATIVE ASSISTANT: Kathleen Morgan
EDITORIAL SECRETARIES: Janice Jung,
Josephine Ortiz, Millie Santos

PUBLISHER: Paul W. Reiss

## *Next ElectronicsWeek*

### New trends in distribution

George Leopold, of our New York bureau, is heading up next week's *ElectronicsWeek* special report, which examines the business of distributing electronic products and systems. The report will detail the new realities in the distribution industry that are changing everything from component distribution to semicustom integrated-circuit shipments. The trend toward an increasing use of in-house design centers will be explained, as will the various players' efforts to differentiate themselves from each other. Distributors and suppliers will also discuss their evolving relationship in a period of change and growth.

### Military semiconductor marching orders

With the military semiconductor market reaching $2.6 billion by 1988, digital signal processors and gallium arsenide devices are heading the Department of Defense's "most wanted" list. In addition to semiconductors that can withstand high radiation levels, the DOD also expects to be looking for much more complementary-MOS logic and memory. Read about the needs of the world's biggest buyer in the next *ElectronicsWeek.*

## *Looking ahead in ElectronicsWeek*

### Selecting robots for today's production and test lines

Robots are entering every phase of manufacturing and production. From assembly lines to testing chambers, they are taking over more and more dangerous and routine tasks, thus freeing people to concentrate on creative enterprises. Graeme Kinsey, of Zehntel Inc. in Walnut Creek, Calif., explains how best to select a robot for industrial use. Such factors as work envelope, repeatability, accuracy, programmability, and many more enter into the selection process. Read about it in an upcoming *ElectronicsWeek.*

*August 20, 1984 Volume 57, Number 19*
*112,906 copies of this issue printed*

ElectronicsWeek (ISSN 0748-3252). Published weekly by McGraw-Hill, Inc. Founder: James H. McGraw 1860-1948. Publication office: 1221 Avenue of the Americas, N. Y., N. Y. 10020; second class postage paid at New York, New York and additional mailing offices. Postage paid at Montreal, P. Q. Registration Number 9034.

Executive, editorial, circulation and advertising addresses: ElectronicsWeek, McGraw-Hill Building, 1221 Avenue of the Americas, New York, N. Y. 10020. Telephone (212) 512-2000. Teletype 12-7960 TWX 710-581-4879. Cable address: MCGRAWHILLNEWYORK.

Subscriptions limited to professional persons with active responsibility in electronics technology. No subscriptions accepted without complete identification of subscriber name, title or job function, company or organization, and product manufactured or services performed. Based on information supplied, the publisher reserves the right to reject nonqualified requests. Subscription rates: the United States and possessions $32 one year, $55 two years, $76 three years; company addressed and company libraries $40 one year, $67 two years, $93 three years; Canada and Mexico $34 one year, $57 two years, $78 three years; Europe $50 one year, $85 two years, $125 three years; Japan, Israel and Brazil $85 one year, $140 two years, $200 three years; Australia and New Zealand $95 one year, $170 two years, $240 three years, including air freight; all other countries $50 one year, $85 two years, $125 three years. Limited quota of subscriptions available at higher-than-basic rate for persons allied to field served. Check with publisher for these rates. Single copies: $3.00. Please allow four to eight weeks for shipment.

Officers of McGraw-Hill Publications Company: President: John G. Wrede; Executive Vice Presidents: Paul F. McPherson, Operations; Walter D. Serwatka, Finance & Services. Senior Vice President-Editorial: Ralph R. Schulz. Senior Vice President Publishers: Harry L. Brown, David J. McGrath, James R. Pierce, Gene W. Simpson, John E. Slater. Vice President Publishers: Charlton H. Calhoun III, Richard H. Larsen, John W. Patten. Vice Presidents: Kemp Anderson, Business Systems Development; Shel F. Asen, Manufacturing; John A. Bunyan, Electronic Information Services; George R. Elsinger, Circulation; Michael K. Hehir, Controller; Eric B. Herr, Planning & Development; H. John Sweger Jr., Marketing; Virginia I. Williamson, Business Development.

Officers of the Corporation: Harold W. McGraw, Jr., Chairman; Joseph L. Dionne, President and Chief Executive Officer; Robert N. Landes, Senior Vice President and Secretary; Ralph J. Webb, Treasurer.

Title registered in U. S. Patent Office; Copyright 1984 by McGraw-Hill, Inc. All rights reserved. The contents of this publication may not be reproduced in whole or in part without the consent of copyright owner.

Where necessary, permission is granted by the copyright owner for libraries and others registered with the Copyright Clearance Center (CCC), 21 Congress Street, Salem, Mass. 01970, to photocopy any article herein for the base fee of $0.50 per copy of the article plus $0.25 per page. Payment should be sent directly to the CCC. Copying done for other than personal or internal reference use without the express permission of McGraw-Hill is prohibited. Requests for special permission or bulk orders should be addressed to the publisher. ISSN 0748-3252/84$0.50+.25.

Subscribers: The publisher, upon written request to our New York office from any subscriber, agrees to refund that part of the subscription price applying to copies not yet mailed. Please send change-of-address notices or complaints to Fulfillment Manager; subscription orders to Circulation Manager, ElectronicsWeek, at address below. Change-of-address notices should provide old as well as new address, including zip codes. Attach address label from recent issue. Allow one month for change to become effective. Subscriber Service: call (201) 356-7980, 9 a.m. to 4 p.m. EST. Postmaster: Please send Address Changes to Fulfillment Manager, ElectronicsWeek, CN 808, Martinsville, N. J. 08836.

**Editorial department phones:** Administration (212) 512-2645, News and New Products (212) 512-2685, Technology (212) 512-2666. Bureaus: Chicago (312) 751-3811, Dallas (214) 458-2400, Los Angeles (213) 480-5234, New York (212) 512-2975, San Francisco/Palo Alto (415) 968-2712, Washington (202) 463-1650, Frankfurt 72-5566, London 493-1451, Paris 720-2070, Tokyo 581-9816. **Business departments:** (212) 512-3469 (a full listing of Business departments follows the Advertisers' Index).

**SIEMENS**

### Programmable timer SAB 0529:

# the digital time machine

With the programmable digital timer SAB 0529 from Siemens you can realize very exact delay times between 1 second and 31.5 hours. Power supply as well as timebase is the 50 Hz line. The device can drive triacs or relays directly, has eight overlapping timing ranges and two modes of operation "momentary switching and switch-off delay".

| Timing range | A | B | C | Basic timing unit | Max. time (50 Hz) |
|---|---|---|---|---|---|
| 1 | L | L | L | 1 s | 63 s |
| 2 | L | L | H | 3 s | 189 s |
| 3 | L | H | L | 10 s | 630 s |
| 4 | L | H | H | 30 s | 1890 s |
| 5 | H | L | L | 1 min | 63 min |
| 6 | H | L | H | 3 min | 189 min |
| 7 | H | H | L | 10 min | 630 min |
| 8 | H | H | H | 30 min | 1890 min |

The SAB 0529 is therefore the suitable timer wherever you need long and accurate delays in switching operation:

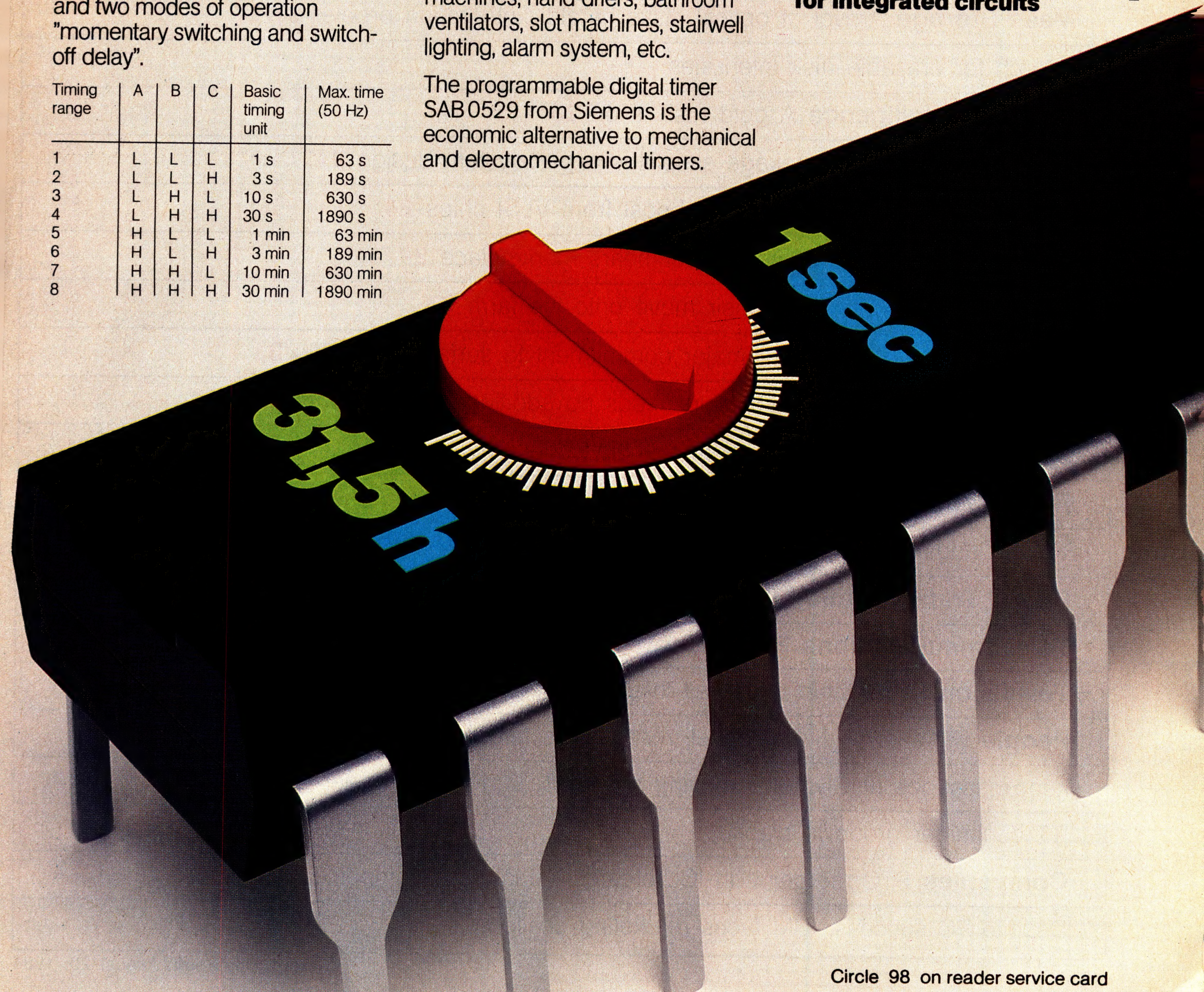
In industrial controller units, for example, safety switches for cooking equipment, coffee/espresso machines, hand-driers, bathroom ventilators, slot machines, stairwell lighting, alarm system, etc.

The programmable digital timer SAB 0529 from Siemens is the economic alternative to mechanical and electromechanical timers.

If you want to find out more, especially about possible applications, write to Siemens AG, Infoservice/B 8414, Postfach 156, D-8510 Fürth, West Germany, quoting "SAB 0529".

**Siemens – your partner for integrated circuits**

B 8414.101



Circle 98 on reader service card

A McGRAW-HILL ELECTRONICS PUBLICATION

# ElectronicsWeek

**OPTICAL MASS STORAGE**
**Huge market predicted for writable disks, 19**

## Technology Around the World

**Personal Computers** IBM makes waves again with a multiuser PC **17**

**Missiles** Hughes's problems with quality and reliability mount **18**

**Mass Storage** Arrival of optical disks heralds integration problems **19**

Search for erasable disk intensifies 20

**Artificial Intelligence** A gold rush is on **23**

**Software** Integrated package simplifies expert-system design **24**

**Arrays** Systolic processing gets boost from VLSI chips **24**

**Optoelectronics** Three-color laser nears marketplace **29**

**Agriculture** Robots make their move onto the farm **30**

**Components** Ford makes major commitment to surface mounting **31**

**Integrated Circuits** Codec chip needs no additional components **32**

Siemens has big plans for its single-chip codec 37

**Robot Vehicles** Optically guided carts to tackle factory jobs **37**

**Trade** Industry group joins hands with bank to boost exports **41**

**Public Transportation** Italians to test computer control **41**

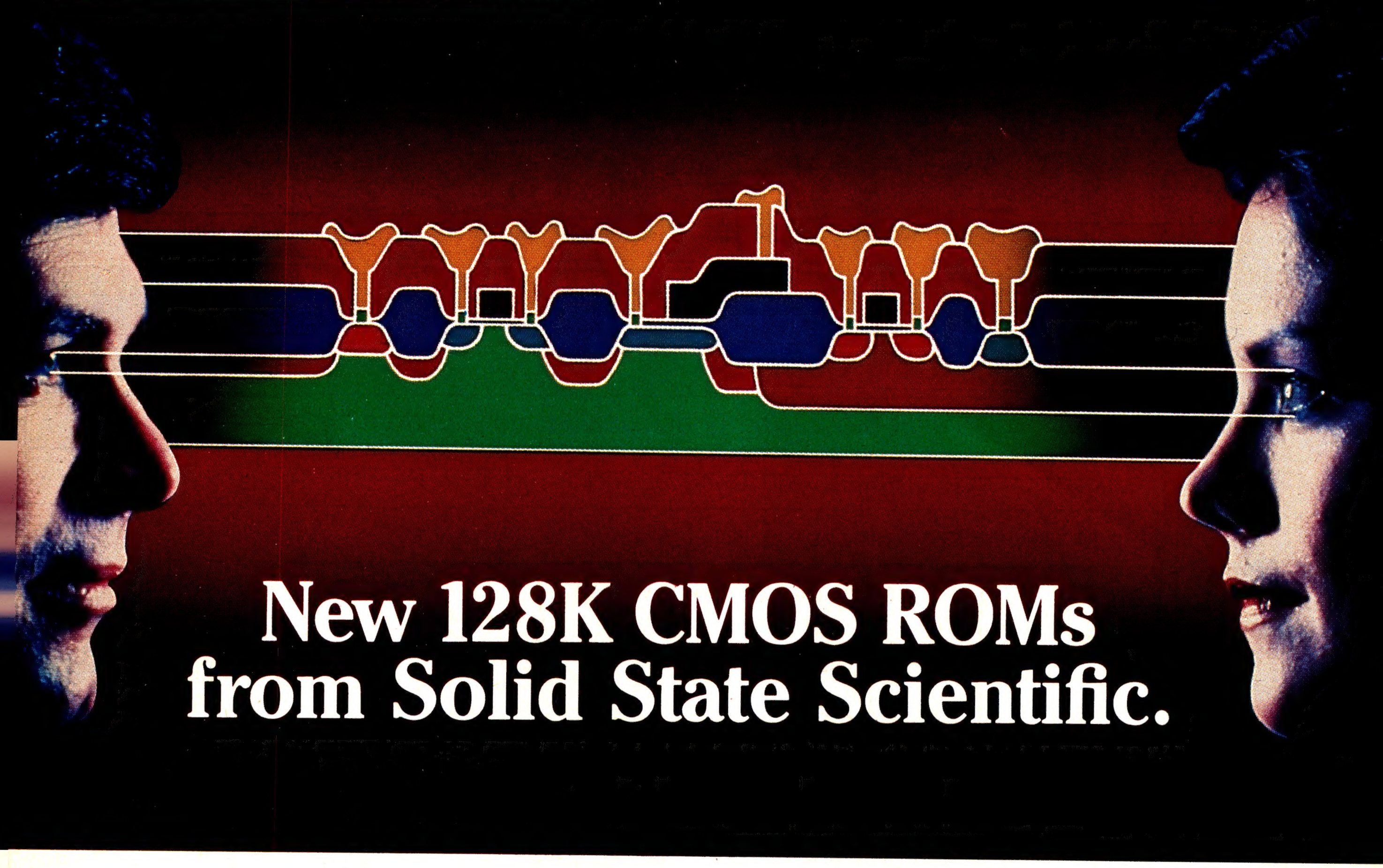
**Telecommunications** Politics delays privatizing of NTT **42**

**Television** Linear chip drives all three cathodes of color tubes **44**

**People** EIA's John J. McDonnell reorganizes telecom group. Walter Corwin kept messages at Olympics moving for AT&T. Ludwig Orth keeps ITT consumer group in black **57**

**Companies** STC merger with ICL creates world-class competitor. Despite PC success, IBM faces marketing challenges **59**

CMOS is a Solid State of mind.

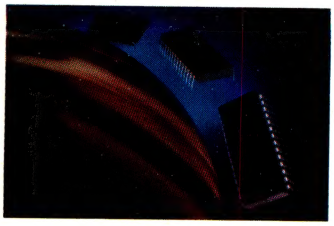


# New 128K CMOS ROMs from Solid State Scientific.

## **Fast** access times (100 ns max.)
## **Faster** system execution.
## **Fastest** turnaround times in the business.

Solid State Scientific has a new 128K CMOS ROM. The 23C128. It's extremely fast—75 ns typical or 100 ns worst case. So you can use it with the world's fastest microprocessors. It has the low power and high reliability of our state-of-the-art CMOS technology. It's available now at prices that make it as cost-efficient as it is technically superior. Production volumes take only 7 weeks, prototypes just 3 weeks.

### Forget your NMOS ROMs and EPROMs



If you're using NMOS ROMs, our new 23C128 can give you far better speed and reliability. If you're using EPROMs, our pre-programmed fast ROMs can speed your system execution by eliminating wait states. With much faster turnaround, too. And, at a cost more than 25% below EPROMs.

### Quick specs on the 23C128

**3 Speeds:** 150, 120 and 100 ns max. **Standby Current:** 50 microamps max. **Operating Current:** 10 milliamps max. LSTTL-compatible inputs and outputs. 28-pin JEDEC standard. Military versions, too.

### Much more CMOS memory coming from SSS

In case you didn't know it, SSS delivered more 32K and 64K CMOS ROMs than any domestic supplier last year. And we're out to do the same with our new 128K CMOS ROM. Other new CMOS memory devices, including a new 256K CMOS ROM, are on the way.

### So why wait?

For details on our new 23C128 CMOS ROM or any of our other CMOS memories or logic devices, just call or write. And find out why CMOS *is* a Solid State of mind. Solid State Scientific, 3900 Welsh Rd., Willow Grove, PA 19090. (215) 657-8400.

**Solid State Scientific**
CMOS ResponsAbility™

Circle 5 on reader service card

VOLUME 57, NO.19 AUGUST 20, 1984

# ElectronicsWeek

## Special Reports

**Data Conversion** Signal processing is demanding more performance, requiring more complex, faster, and more accurate analog and digital converters. As in most other IC areas, CMOS is becoming the dominant technology **63**

**Software** Although structured analysis has long been recognized as an effective technique for developing system specifications, it is a tedious procedure. But with a set of new CAD tools, software engineers can reap its benefits **69**

## New Products

**Networks** Server links Ethernet with IBM mainframes **77**

**Data Converters** A-d converter family includes power misers **78**

**Microcomputers** IBM PC-compatibles offer foreign language MS-DOS **80**

**Peripherals** Auto-loading tape transport starts, stops, streams **84**

**Integrated Circuits** CRT chip set does windows **86**

**Development Systems** Portable works alone or as peripheral **88**

**Instruments** Unit tests memory access time. Portable scope has built-in voltmeter **90**

**Power Supplies** Kilowatt switcher manages loads three ways **92**

**Production Equipment** Laser trimmer is fast **93**

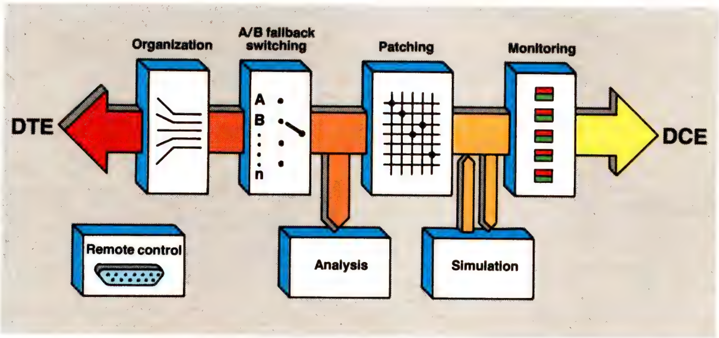
**Optoelectronics** Miniature sensor has new package **93**

## Features

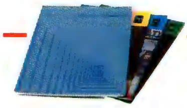
**Departments** Previews **2** Meetings **8** ElectronicsWeek Index **48** Washington Insight **54** Letters **96** New Literature **99** Employment **101** Editorial **104**

# Artistry instead of crashing: have your data system on the alert.

hannel has failed: switch over
ckly ... what a cable mess ...
that was the wrong plug ... im-
t. Now the second data link
s crashed. And it could have
en avoided. Our Diagnostic
work Control Systems DNE
their preprogrammable
tching sections establish clarity
onnection and do not leave
outing up to chance. Preset fall
k channels can be called up
r free and within seconds.
ple arrangements for a/b
tching and reconnection will
be easier with our DNE family.
mportant interface control
als can be displayed, bridging
s for a data analyzer selected
or access made for simulators. From manual pocket instruments to completely automated systems under terminal control – Wandel & Goltermann has the right solutions to guarantee secure and reliable operation of your datacom network. We are specialists as a single source of data analyzers, simulators, and a variety of test instruments. Our name represents quality and reliability.



le 99 on reader service card



Please send:
☐ Brochures on DNE systems
☐ Digest on datacom technology
☐ A sales engineer

Name ..........................................
Company ..........................................
Address ..........................................
Country ..........................................
Tel. No. ..........................................

E 3268 KF

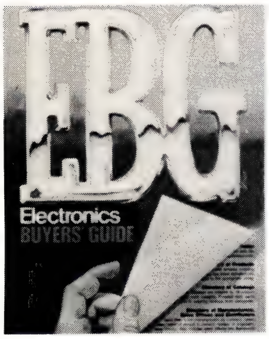
**Wandel & Goltermann**

P.O.Box 45 · Abt. VW
D-7412 Eningen u. A.
Fed. Rep. of Germany
Tel. +(49) 7121-8911
Telex 729833 wug d

EW 20884

NOW AVAILABLE!

1984-85
Electronics Buyers' Guide



Order your copy today for the industry's most often-used directory:

- It's three directories in one
- Includes more than 4,000 product listings. (approx. 700 pages)
- Contains over 5,000 company listings (approx. 400 pages) including:
  - Company name, address and phone number.
  - Name and title of contact for sales information.
  - Number of engineers at plant and number of employees.
  - Annual dollar sales volume.
  - Local sales offices and manufacturers representatives.
  - Local distributors.
  - Instant referral to company's advertisements.
- Offers FREE current catalog retrieval service (approx. 1300 catalogs)
- Contains a directory of trade names.

**Price: $50 per copy**
(Add $20 for air mail)

Send order with payment to:
Barbara Copcutt
**Electronics Buyers' Guide**
McGraw-Hill House
Maidenhead SL6 2QL,
England

# Meetings

**27th Biennial International Electrical, Electronics Conference, and Exposition,** Canadian Region, IEEE (The Hilda Wilson Group, 20 Eglinton Ave. E., Suite 203, Toronto, Ontario M4P 1A9 Canada), Metro Toronto Convention Centre, Toronto, Oct. 7-9.

**National Conference on the Advancement of Research,** National Research Council (Chester McKee, Office of Scientific & Engineering Personnel, National Research Council, 2101 Constitution Ave. N.W., Washington, D.C. 20418), Colonial Williamsburg, Va., Oct. 7-10.

**International Conference on Computer Design,** IEEE (Albert E. Ruehli, IBM Corp., Thomas J. Watson Jr. Research Center, P.O. Box 218, Yorktown Heights, N.Y. 10598), Rye Town Hilton, Port Chester, N.Y., Oct. 7-11.

**International Technology Transfer Congress,** International Technology Institute (Rose Mary Surgent, ITI, 7125 Saltsburg Rd., Pittsburgh, Pa. 15235), Pittsburgh Hilton Hotel, Pittsburgh, Oct. 8-10

**60th Fall Conference,** Electronic Industries Association (Mark V. Rosenker, Public Affairs, EIA, 2001 Eye St. N.W., Washington, D.C. 20006), Los Angeles, Oct. 8-11.

**Conference on Investment in Hong Kong and People's Republic of China,** Hong Kong General Chamber of Commerce *et al.* (The Adsale People, 21/F Tung Wai Commercial Bldg., 109-111 Gloucester Rd., Wanchai, Hong Kong), Shangri-La Hotel, Hong Kong, Oct. 9

**Advances in Microprocessor Peripherals,** IEEE (Scientific Committee, Secrétariat des Journées d'Electronique et de Microtechnique, Département d'Electricité-EPFL, 16, Chemin de Bellerive, CH-1007 Lausanne, Switzerland), Switzerland, Oct. 9-11.

**16th National SAMPE Technical Conference,** Society for the Advancement of Material and Process Engineering (Marge Smith, National SAMPE Business Office, P.O. Box 613, Azusa, Calif. 91702), Four Seasons Motor Inn, Albuquerque, N.M., Oct. 9-11.

**Electronics Manufacturing Technologies and Systems Conference,** Society of Manufacturing Engineers (SME, Public Relations Department, 1 SME Drive, P.O. Box 930, Dearborn, Mich. 48121), North Carolina State University, Raleigh, N.C., Oct. 9-11.

**Third Southwest Computer Conference,** SWCC (E.Z. Million, SWCC, P.O. Box 950, Norman, Okla. 73070), Tulsa Convention Center, Tulsa, Okla., Oct. 9-11.

**International Conference on Systems, Man, and Cybernetics,** IEEE (M.E. El-Hawary, Technical University of Nova Scotia, P.O. Box 1000, Halifax, Nova Scotia, Canada, B3J 2X4), Chateau Halifax Hotel, Halifax, Oct. 9-12.

**Electronics and Automation,** Trade Commission of Norway (Karen Mehren, Deputy Trade Commissioner, Trade Commission of Norway, 800 Third Ave., New York, N.Y. 10022), Sjolyst Exhibition Center, Oslo, Norway, Oct. 9-13.

**Localnet 84,** Online Conferences Ltd. (Online Conferences Ltd., Pinner Green House, Ash Hill Dr., Pinner HA5 2AE, Middlesex, UK), Sheraton Harbor Island Hotel, San Diego, Oct 10-12.

**15th Korea Electronics Show,** Ministry of Commerce and Industry, Republic of Korea (Electronics Industries Association of Korea, C.P.O. Box 5650, Seoul, Korea), Korea Exhibition Center, Seoul, Oct. 10-14.

## Seminars

**The Military Electronics Market,** Electronic Industries Association (EIA, Government Division/Requirements Committee, 2001 Eye St. N.W., Washington, D.C. 20006), Century Plaza Hotel, Los Angeles, Oct. 9-11.

## Discover HP's revolutionary answer to your measurement needs

*Introducing an extremely versatile solution to your measurement needs: The HP 7090A Measurement Plotting System. By merging several technologies –waveform recording, digital plotting, analog recording, and automated measurement–the HP 7090A provides a powerful solution to a broad range of measurement problems. Imagine... significantly increasing your ability to measure and display low frequency phenomena and, at the same time, substantially improving your real-time recording and digital plotting results. All in one* low-cost *system!*

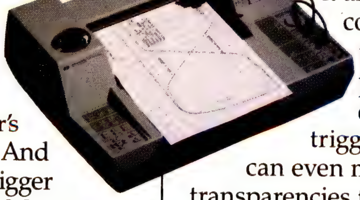
# Hewlett-Packard's new 7090A– the single-instrument solution for low frequency measurement, analysis and documentation

### Now you can capture low frequency (<3kHz) signals.

The HP 7090A precisely measures, stores and displays signals through simultaneous sampling on each of three channels, with 12-bit resolution, a bandwidth of dc to 3kHz (33.3k samples/s maximum) and a 1000 word memory per channel.

### You get 6 trigger mode flexibility.

Virtually any signal change can now initiate signal capture through HP's six trigger modes Even decaying repetitive signals, such as faults in a power line voltage or in a transducer's carrier, can be captured. And combined with our pretrigger capability, the HP 7090A Measurement Plotting System is your ideal system for turn-on/turn-off characterization, fault monitoring and mechanical motion analysis.



### Plus, it's a system component.

All panel functions of the HP 7090A are programmable via the HP-IB interface. And data can be streamed at up to 500 points/s from either the internal 1K buffers, or in real time from the analog-to-digital converters. A menu driven software package is available for HP Series 200 computers, allowing you easy data manipulation, storage/retrieval, and system integration.

### And the HP 7090A gives you much more...

The HP 7090A is also a high performance real-time X-Y recorder, digital plotter and DVM. In a stand-alone mode, it annotates setup conditions, date and time, selected data points from memory and even the trigger time. Plus, you can even make overhead transparencies for technical presentations!

### The HP 7090A is your low-cost, one-stop system.

From its 3 analog inputs to its 6-pen writing system, the HP 7090A adds a totally new dimension to low-frequency measurement, analysis and display. And with a price tag of only $4400,* the HP 7090A is your complete measurement plotting system.

### Send today for your free information package.

Clip out and mail the coupon below to receive–absolutely free–a complete information package, including our detailed brochure and specifications.

*Domestic U.S. price only

**HEWLETT PACKARD**

1101405

YES! I need a one-stop breakthrough solution like this in my lab. Please send me more information about Hewlett-Packard's new HP 7090A Measurement Plotting System.

Name

Title

Address

City State Zip

Phone ( )

Detach and mail to:
Hewlett-Packard
16399 W. Bernardo Drive,
San Diego, CA 92127
Attn: Marketing Communications 11405 EL8

Circle 9 on reader service card

# MEET THE STRONGEST

There's a lot more to a Fujitsu gate array than glass, gold, and aluminum; it's the human element that really sets our product apart.

When you order a Fujitsu gate array, you become part of a team. You work through your objectives with a highly-skilled design engineer who knows silicon the way you know logic.

That way, you combine your expertise with ours to shape the subtleties of silicon into product advantages.

Instead of glitches.

This approach is a good part of the reason that since 1974, Fujitsu has produced more than 3,000 gate array designs – and every one of them has worked according to plan.

Our engineers can help you execute designs in a complete range of technologies – CMOS, TTL, ECL – you name it. Because the Fujitsu team's incredible versatility comes from a solid background within each of those technologies.

That's how you get numbers like these:

CMOS

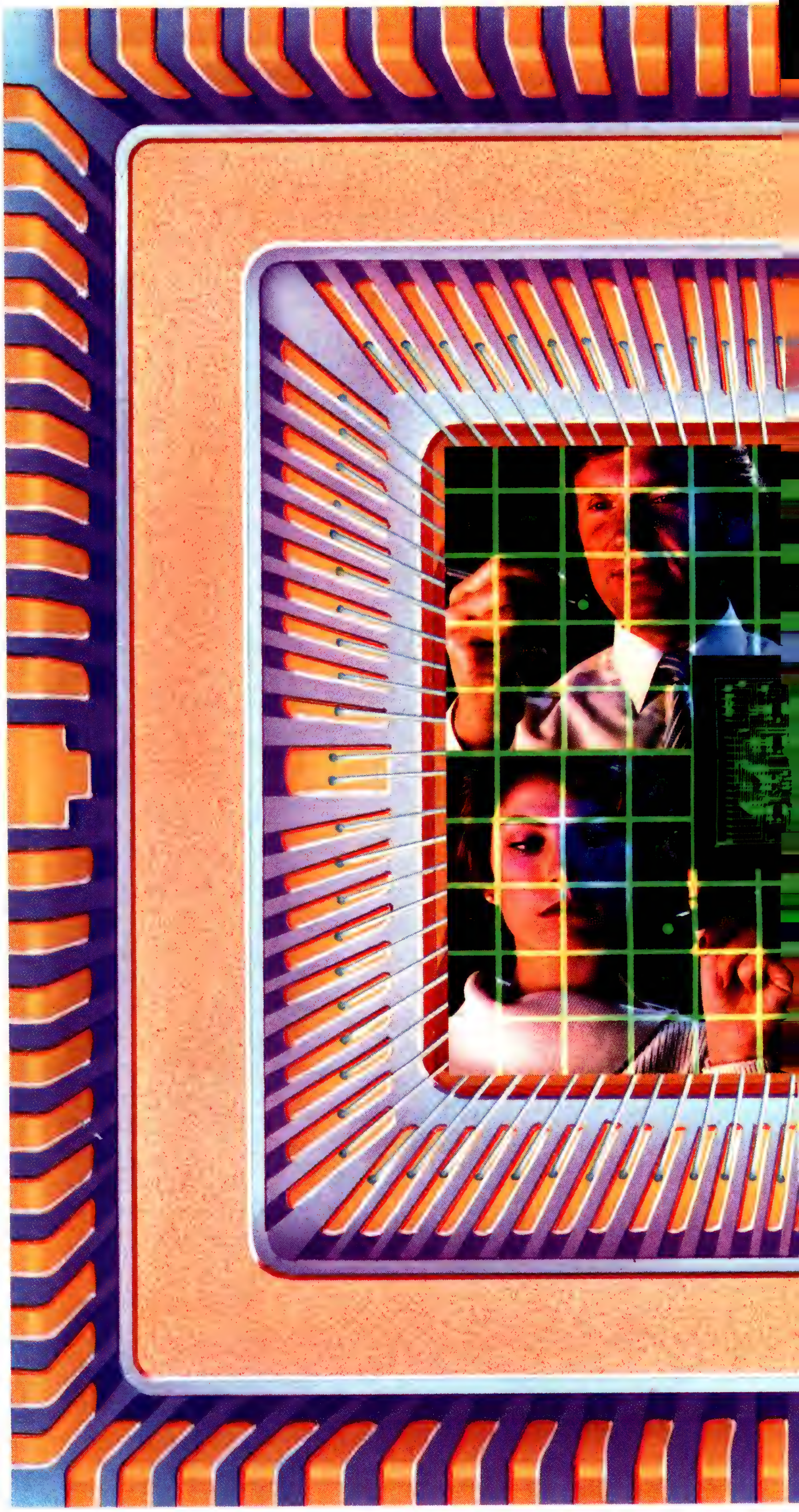
| TECHNOLOGY | GATE LENGTH | PROP DELAY TIME* | GATE COUNT |
|---|---|---|---|
| STD CMOS | 3.6 μ | 7.0 ns | 700-3900 |
| H CMOS | 2.8 μ | 5.0 ns | 440-3900 |
| VH CMOS | 2.3 μ | 2.5 ns | 2600-8000 |

*2-Input NAND Gate, F/O = 2

BIPOLAR

| TECHNOLOGY | PROP DELAY TIME* | GATE COUNT | POWER DISSIPATION PER GATE |
|---|---|---|---|
| LSTTL | 1.8 ns | 500 | 2.3 mW |
| LSTTL | 1.9 ns | 240-1100 | 0.8 mW |
| LSTTL | 0.95 ns | 2000 | 0.65 mW |

*3-Input NAND Gate, F/O = 1



# TEAM ON THE CIRCUIT.

There are now three fully equipped Fujitsu Gate Array Design Centers in the U.S.; in Boston, Dallas, and Santa Clara. There's a sophisticated telecommunications network between centers, and high-speed leased-line and satellite communications with FMI host computers in Japan. All that, and a first-class gate array design team, too. With you as star player.

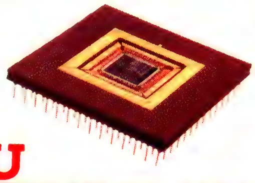
Call the FMI Design Center nearest you. We'll show you how to get our team on your circuit.

Boston Design Center
57 Wells Avenue
Newton Centre
Massachusetts 02159
(617) 964-7080

Santa Clara Design Center
3320 Scott Boulevard
Santa Clara, CA 95051
(408) 727-1700

Dallas Design Center
1101 East Arapaho Road
Suite 225
Richardson, TX 75081
(214) 669-1616

Literature request line: 800-556-1234 (ext. 82)
In California, 800-441-2345



**FUJITSU**
**MICROELECTRONICS, INC.**
**Technology that works**
3320 Scott Boulevard, Santa Clara, CA 95051 · (408) 727-1700

Circle 11 on reader service card

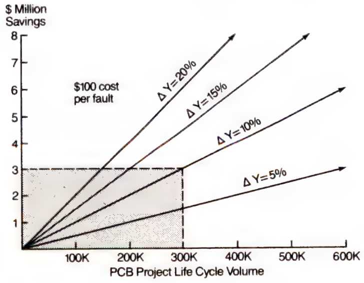
# How L200 board testing and simple arithmetic can save you millions.

Discover why Teradyne's L200 is absolutely the best board test system available today. And how it can save you millions.

We figure it this way.

If you're going to build boards with technology like 8088's, 68000's, gate arrays, or custom VLSI, then you just can't test a better way. Thanks to a unique Teradyne invention called MultiMode,™ you'll get superior yields at system test.

MultiMode integrates in-circuit and functional testing in one system. It's just the item for complex VLSI designs. This capability lets the L200 generate yields on the order of 95% plus. An average greater by a full 10% than any competitive system.

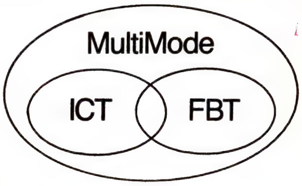


*Increased yield is provided by higher fault coverage. And the savings are dramatic.*

No tester does it better. And in a world where improving yields just 1% can mean savings of $1 million, it's a terrific advantage.

**MultiMode Testing. Or 1+1=3.**

By integrating in-circuit and functional testing,



*Combining in-circuit and functional test techniques in one system. That's the secret of MultiMode.*

MultiMode really is a case where the total is more than the sum of the parts.

This integration is what makes us so certain your yields will improve. MultiMode lets you apply both testing techniques in a single, comprehensive test program to find faults at the most effective level—device, cluster or board.

It's a strategy that stops faults from slipping through undetected. It's based on efficient programming, and on efficient diagnostics. Together making sure you get the highest levels of fault coverage as fast as possible.

And using MultiMode testing on a single powerful machine lowers work-in-process inventory build-ups around separate testers. Reduces board handling. And increases throughput.

With higher test quality, more efficient programming, and lower operating costs, the L200 actually lowers lifecycle testing costs for modern VLSI boards.

And that's money in the bank for you.

### A Brilliant Deduction.

It's a proven solution. MultiMode testing delivers yield advantages on modern VLSI boards. More than 100 machines are already demonstrating this every day. For manufacturers of personal, mini and mainframe computers, telecommunications switching systems, avionics, and other advanced high tech products.

The L200 costs more than other testers out there. But it's worth it. Using MultiMode, your staff will get high fault coverage faster than ever before. And give you yields at system test that can save you millions.

It all adds up to one thing. Call Teradyne today, (617) 482-2700. Or write Teradyne, 321 Harrison Avenue, Boston, MA 02118.

**TERADYNE**

*We measure quality.*

Circle 13 on reader service card

For
six years
we've been telling you
about the benefits of
Programmable
Array Logic.

And
for six years
you've refused to leave
asynchronous logic
behind.

# OK, you win.

Here's the first PAL® circuit for asynchronous logic designs.

The PAL 20RA10.

It has everything you need to put your design on silicon in a hurry. While you chase as many as a dozen TTL parts off your board.

A guaranteed 30ns clock-to-output time.

20 inputs.

10 outputs that can be clocked separately. Each with programmable asynchronous set and reset.

Programmable registers. Each with an independent transparent mode.

Programmable output polarity, so you won't even need an inverter circuit.

The whole thing sits in a sleek 24-pin SKINNYDIP® package.

And the programming is a snap.

Using PALASM,™ our enhanced CAD software, and a standard PAL programmer, you can design and program an asynchronous PAL circuit in just hours.

You can build a prototype in seconds.

And when your design is stable, you can crank out as many PAL circuits as you need. Or you can convert to our mask-programmed HAL® circuits.

So you win.

You get the profound benefits of programmable array logic.

Without leaving your asynchronous logic behind.

Call your Monolithic Memories representative or franchised distributor for our PAL 20RA10 data sheet and an applications packet.

Or write Monolithic Memories,
2175 Mission College Blvd., Mail
Stop 9-14, Santa Clara, CA 95054.

PAL and HAL are registered trademarks and PALASM is a trademark of Monolithic Memories, Inc. © 1984 Monolithic Memories, Inc.

**Monolithic Memories** MMI

Circle 15 on reader service card

# BOB, CAROL, TED & ALICE

## How Four Innovative Design Engineers Found Happiness Using The New DASH-1™ Schematic Design System.

**BOB: "DASH-1 keeps me under budget and ahead of schedule..."**

"DASH-1 has freed my designers from the drudgery of manual schematic design and documentation. Now, we can knock out complex designs in a fraction of the time it used to take. Using the huge DASH-1 parts library (on disk) we can instantly call up any symbols we need — all with pinouts and pin functions. Also, our amazing DASH-1's automatically generate Net Lists, Lists of Materials, Design Check Reports and other critical documents. I'm a hero in my company now, with productivity at an all-time high."

**CAROL: "DASH-1 helped save our CAD Systems..."**

"My company has a big investment in large CAD systems. But for a long time I noticed our engineers were frustrated. They'd send in schematic sketches only to get back drawings and documents that were completely different. The poor engineers would spend hours checking, changing and red-lining. DASH-1's family of CAD translators, to front-end all of our large systems, has changed all this. And back annotation is easy. DASH-1 has provided our engineers easy access to those previously difficult-to-use and inaccessible CAD tools."

**TED: "Imagine! Simulation right at my desk..."**

"I'm even more sold on my DASH-1 with its new simulator. After I complete my schematic, I have a closely coupled logic and fault simulator that I can run at my desk. I can analyze my designs much faster — and put them into production without delay. FutureNet calls it the DASH-1 CADAT.™ I call it a miracle because I can handle designs as large as 10,000 gates right at my desk, and up to 100,000 gates using a FutureNet CAD translator. Thanks to DASH-1, simulating is stimulating!"

**ALICE: "DASH-1 keeps growing — as we do..."**

"Ours was a start-up company — but it's growing fast. One of our first investments was a DASH-1 (about the price of an IBM PC or XT system) to speed up schematic design and documentation. Since then, FutureNet has added all kinds of low-cost enhancements. Things like CAD translators; direct-connections to most computers; the STRIDES hierarchical package with 99 levels of structured design nesting; the powerful CADAT simulator, pen plotter options, and hot new features, like Rubber Banding, Tag and Drag, and Snap. We're with FutureNet... for now and the future."

FutureNet, DASH-1 and STRIDES are trademarks of FutureNet Corporation. IBM is a registered trademark of the IBM Corporation. CADAT is a trademark of HHB Softron, Inc.
DASH-1 CAD Translators (Partial List): APPLICON, CADAM, CADAT, CALAY, CALMA, CBDS, COMPUTERVISION, GERBER, RACAL-REDAC, SCICARDS, TEGAS.

FutureNet®

**FutureNet Corporation** • 6709 Independence Avenue
Canoga Park, CA 91303-2997 • TWX: 910-494-2681
(818) 700-0691

Authorized IBM Value-Added Dealer

Productivity of the Future... today.

Circle 16 on reader service card

AROUND THE WORLD

# IBM JUMPS UP A LEVEL WITH MULTIUSER PC

Broadband local network and Microsoft's Xenix operating system turn up with top-of-line multitasking PC based on Intel 80286 ☐ *by Robert J. Kozma*

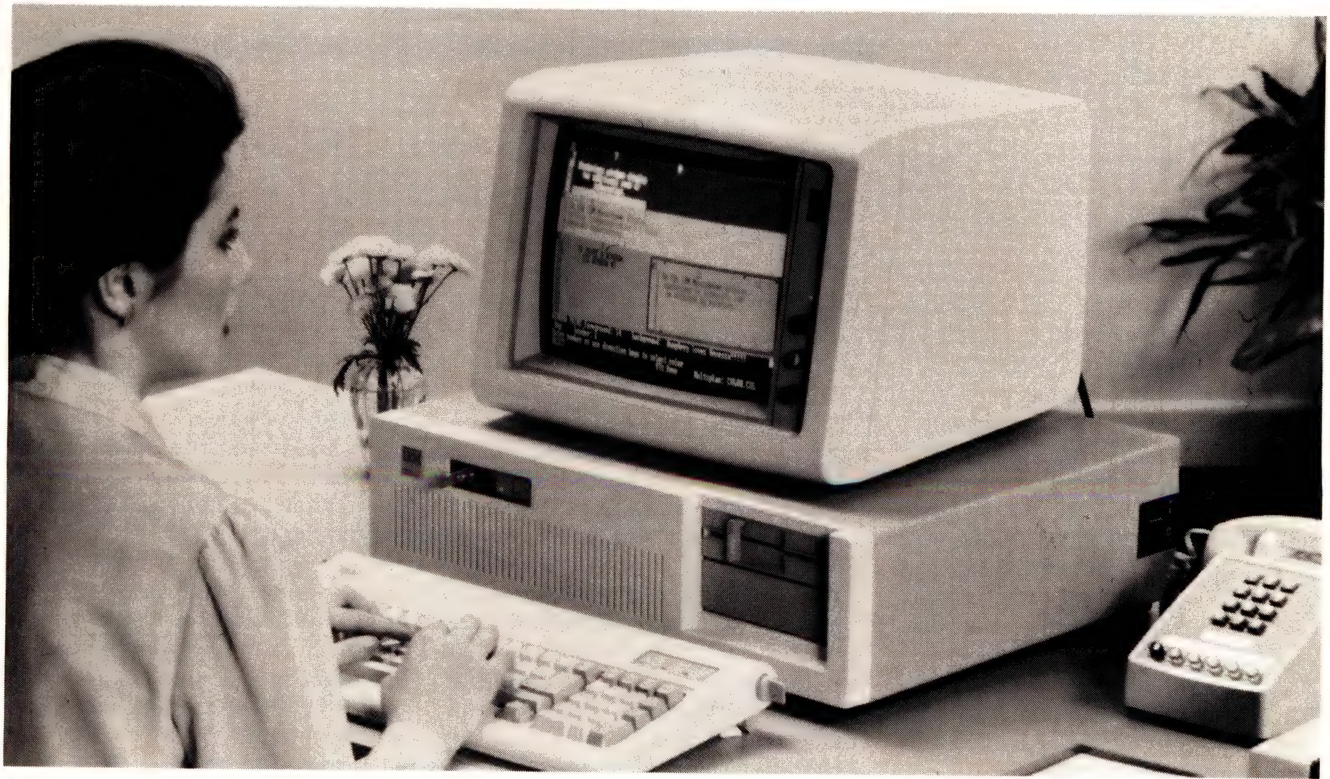
**New York**

First came the Personal Computer, the product that spawned what seemed to be a thousand imitators and helped send the semiconductor industry to new highs in production. Now IBM Corp. has brought out its long-awaited and—for its competitors—much feared Personal Computer AT (for Advanced Technology).

The new system from the Armonk, N.Y., firm appears just as capable as its predecessor of turning the personal computer industry topsy-turvy because of its performance and pricing. At the same time, it may well create severe shortages of Intel Corp.'s 80286 microprocessor as clones emerge.

"It's a very attractive machine and an excellent move. IBM not only becomes the price leader [in personal computers], but the technology leader in the market as well," observes George F. Colony, president of Forrester Research Inc., a Boston market research firm. "That's quite surprising for IBM in this market."

The PC AT is available in two models. At $3,995, the basic configuration comes with terminal, keyboard, processor with 256-K bytes of internal memory, and a 1.2 megabyte floppy disk drive. An enhanced version with 512-K bytes of internal memory, a 1.2-megabyte floppy disk, and a 20-megabyte fixed disk drive with serial/parallel adapter sells for $5,795. Both systems can be expand-



**Aggressive.** IBM Corp.'s long-awaited Personal Computer AT is aggressively priced. The new multitasking, multiuser system, which is based on the Intel 80286 chip, comes in two models, which sell for $3,995 and $5,795.

ed to contain over 3 megabytes of internal memory as well as up to 41.2 megabytes of disk storage. Forrester's Colony expected the enhanced PC AT to cost approximately $8,000.

**Chip squeeze.** IBM's unveiling of the PC AT raises the question of Intel's ability to supply the eagerly anticipated 80286 processor in quantities that will satisfy the demands of both PC buyers and other systems vendors. The Santa Clara, Calif., firm says that it has over 300 design wins for the 80286.

David Wilson, of Future Computing Inc., Dallas, Texas, thinks there's no question there will be a shortage of 80286 chips for the personal computer industry. "The only question that remains is how bad is it going to be?" He predicts that within two years there will be just as many people using the 80286 as there are using the 8088 now.

Intel sources acknowledge that the firm has licensed IBM to manufacture the 80286. "The data base transfer has taken place," one spokesman says, meaning that IBM can make all the 80286s it wants, but probably has not had time to start production.

To operate the PC AT, IBM is offering PC-DOS 3.0, an enhanced version of its original PC-DOS operating system. Priced at $65 and available now, the single-user PC-DOS 3.0 from Microsoft Corp., Bellevue, Wash., can also be used with other existing PC products. Multitasking is available through a new software program called TopView, priced at $149.

Microsoft's Xenix operating system software will also be available for the PC AT in the first quarter of next year at $395. Xenix, Microsoft's version of the multitasking, multiuser System III Unix operating system developed by AT&T Co., supports one to three users on the PC AT. Microsoft plans to have a version of Xenix based on System V later this year.

Besides those products, IBM has developed a broadband local networking product called PC Network. The network, which operates at 2 Mb/s on coaxial cable, is a carrier-sense, multiple-access protocol with collision detection that will work with any IBM PCs.

PC Network closely resembles the 2-Mb/s broadband CSMA/CD network that was offered as a possible industry standard at last month's meeting of IEEE Committee 802.3 in Vancouver, B.C., Canada. Sponsors of that net are Sytek Inc. of Mountain View, Calif., Intel, and General Instrument Corp. Like PC Network, the proposed standard can be implemented with the Intel 82586 Ethernet chip and the 80188 microprocessor. That network, like PC Network, uses standard 75-Ω broadband coaxial cable, similar to that used in the cable TV industry. Like Intel, Sytek has a connection with IBM: it says it supplies broadband local-net products to the computer maker.

To hook up with the PC Network, each PC needs a PC Network adapter, which is priced at $695 and will be ready in October. A network translator unit ($595 in October) connects up to 8 PCs. A network base expander ($59) and various sizes of connecting cable can increase the network to 72 PCs within a 1,000-ft radius, although IBM says up to 1,000 PCs could be linked together in a custom designed and installed broadband network.

In a "statement of direction" issued last week, IBM says it plans to connect the new PC Network and a planned industrial local network—first proposed by IBM last May—with the token-ring local network that the firm hopes to complete within 2 to 3 years.

For software firms and add-on hardware makers, the new system represents "at least two more years of commitment from IBM in favor of open-system architecture," thinks Scott Anderson, president of Ann Arbor Software, Ann Arbor, Mich. Anderson, along with other third-party vendors attending an IBM-sponsored meeting in Dallas to debut the system, was relieved that rumors of proprietary IBM PC operating systems proved false.

"It's clearly a big winner from the compatibility issue, especially considering that it is a full 16-bit system" whereas the 8088-based PC has 8-bit I/O capability, notes Daniel H. Fylstra, chairman of VisiCorp of San Jose, Calif.

To help sell its PC family, IBM plans a promotion in conjunction with Proctor & Gamble Co. of Cincinnati. IBM computers will be promoted on boxes of P&G products. Consumers will receive fliers in the mail offering certificates worth $100 off the purchase of PCjr systems.

## MISSILES

# Poor quality control shoots down TOW line

**Washington, D.C.**—Under pressure from the Pentagon, Hughes Aircraft Co., Culver City, Calif., has shut down its Tucson, Ariz., plant's third tactical-missile production line—which handled the Army's Tube-launched, Optically-tracked, Wire-guided (TOW) antitank missile—in the face of charges of poor quality control.

The mid-August action occurred less than a week after the Air Force refused, on the same grounds, to accept further delivery of Imaging Infrared (IIR) Maverick missiles from Hughes, and within two months of a similar Navy suspension of deliveries on its AIM-54C Phoenix missile. In addition to the production line shutdowns, progress payments on the missiles were suspended.

Air Force investigators found bad soldering connections, exposed wires, and loose screws during a teardown inspection in late July of one of the AGM-65D IIR Maverick missiles. The subsequent shutdown of the missile production line—which had been producing only 10 missiles per month—followed an Air Force Systems Command team product review of the three missiles produced by Hughes at the Tucson plant. In addition to the IIR Maverick, the AFSC team reviewed the Navy's Phoenix and the Army's TOW.

A production cutoff of the Army's missile came amid reports in Wash-

**Dud.** Charges of poor quality control of the TOW missile, seen here being test-fired from a jeep at Camp Lejeune, N.C., have caused the Hughes production line to be shut down.

ington—which were quickly denied by the Army—that between a third and a half of the more than 300,000 TOW systems already in the inventory of the Army and its North Atlantic Treaty Organization allies could have reliability problems. In production some 15 years, TOW entered its third generation last year with the TOW II.

The Army had proposed buying some 18,000 TOW missiles in 1985 if its $265 million budget request is approved. Over the next five years, purchases of the infantry-fired weapon are expected to reach 100,000 units.

One problem with TOW is that the wire guiding the missile to its target sometimes breaks, with a resultant loss of control, the Army admits. Another problem facing the inspection teams is that the missile seams are welded, rather than riveted, making it difficult to open the missile for inspection without literally destroying it. But Pentagon spokesman Michael Burch insists the problems are minor and that test firings of more than 12,000 TOW missiles over the past 14 years have consistently exceeded the Army's 90% reliability goal.

**Raytheon benefit.** The Air Force action on its IIR Maverick could prove beneficial to Raytheon Co., the system's second production source. As with the TOW and, before that, the Navy's Phoenix, the Air Force's suspension of production of the air-to-ground missile stemmed from what were labelled serious weaknesses in quality control at the Hughes Tucson plant. In addition, Raytheon, of Lexington, Mass., is a second source on the Air Force's Advanced Medium-Range Air-to-Air Missile (AMRAAM), also under contract to Hughes.

AMRAAM, not yet in production, is about six months behind schedule on a tight timetable that calls for designing and building missile prototypes within 50 months. The main difficulty is reported to be in satisfactorily miniaturizing the radar and computer electronics package to fit in a 7-in.-diameter missile body. Hughes says the AMRAAM schedule will not slip further.

The financial effects of the Tucson troubles on Hughes are expected to grow worse as the shutdown continues. The company has acknowledged that the Maverick program also is losing money, as is AMRAAM, and the profitability of the Phoenix program is increasingly in question. The company announced simultaneously with the production cutoff that it is sending its top manufacturing officer, C. Blaine Shull, a corporate vice president, to take charge of all Tucson operations.

Unless Hughes makes the required improvements within 90 days of the Air Force's Aug. 3 suspension, the company has been warned that its quality control program for the IIR Maverick will be disapproved, an Air Force spokesman says. Such a procedure will require an extended period for approval of a new system, and should that come about, it could be very damaging for Hughes, says a missile industry expert.

Hughes reportedly has been tooling up to a monthly production rate of 350 IIR Mavericks, more than double its existing capacity of 150. The programmed build-up was to meet the fiscal 1984 delivery of 1,980 missiles. A later increase in capacity to 500 missiles per month in fiscal 1985 was postponed by the Air Force in May. –**Ray Connolly**

## MASS STORAGE

# Advent of optical disk systems a mixed blessing for integrators

**The new crop** of read-only and write-once optical-memory products offers some good news and some bad news for systems integrators. The good news: writable optical disks have finally arrived and will become available in original-equipment-manufacturer quantities by as early as the end of this year.

The bad news: integrators must now figure out how to mesh the new storage technology with existing magnetic gear. Handsome rewards await those who figure out how. In the recently published *Optical Data Storage Outlook* [*ElectronicsWeek*, Aug. 6, 1984, p. 22], Raymond C. Freeman Jr., the disk storage sage of Santa Barbara, Calif., predicts that the market for storage systems based on optical disks will expand from virtually nothing in 1984 to some 2.4 million units worth $7.3 billion by 1990 (see table).

It has been some nine years since the first prototypes of the writable optical disk—a technology that promises storage densities 10 to 100 times higher than magnetic disks—were demonstrated by N.V. Philips, Eindhoven, the Netherlands, for the U.S. Government.

"It's an evolving technology—technically, in product definition and applications," says Leonard Laub, at Vision Three Inc. in Los Angeles, who has been watching the growing pains of optical storage technology for more than 20 years. "There is no mainstream yet. There are only plausible mainstreams, and most of them are built around replacing magnetic storage."

SALES OF OPTICAL DISK DRIVES
(THOUSANDS OF UNITS)

| | 1984 | 1987 | 1990 |
|---|---|---|---|
| Low-end (less than 1 gigabyte) | 0.6 | 314 | 1,995 |
| Midrange (1.5 – 3 gigabytes) | 0 | 44 | 284 |
| High-end (above 3 gigabytes) | 0 | 0 | 110 |

SOURCE: FREEMAN ASSOCIATES

In his view, designers and systems integrators who expect simply to replace magnetic storage with optical may wind up with, well, slipped disks. What's needed, Laub says, is some thinking about how to integrate optical technology with magnetic storage to build subsystems of memory.

Among those thinking along such lines is Edward LaBudde, president of LaBudde Engineering Corp., Westlake Village, Calif. His musings have led to the conviction that "image applications are really the best use of optical technology."

But, he warns, "there is no way in hell people can design, build, test, and ship a system" as complex as that required for massive image and document storage using the same architectures designed for magnetic data storage.

Besides wrestling with new architectures for data storage, designers will have to choose from among three different optical storage technologies: read-only, write-once, or erasable. Performance matches up with three market segments: a low end, oriented toward personal computer storage of less than 1 gigabyte; a midrange, for micro- and minicomputer storage requiring up 3 gigabyte; and a high end, at greater than 3 gigabyte.

Read-only and write-once drives are expected to start showing up in OEM quantities at the end of this year or the beginning of next year. The erasables should begin to emerge in the fall of 1985.

As for the read-only technology, it had its genesis in the consumer audio disk. It is expected that it will find its niche in those applications where multiple copies of a master disk are required for many distant users—personnel training applications or electronic document distribution, for example. These drives cost from $1,000 to $2,000 in OEM quantities.

Offerings from a quartet of companies are available or in sight. Laserdata Inc., Cambridge, Mass., provides microcomputer users with a controller to access video, audio, and digital signals written into a standard 12-in. video disk.

Reference Technology Inc., Boulder, Colo., shipped four units of its read-only drive for beta testing in mid-May. It expects to start volume shipments in mid-September, according to Jane N. Ryland, manager of marketing support.

Hitachi Sales Corp. of America, Lyndhurst, N.J., says that its 552-megabyte compact disk read-only memory drives will be available in April. Panasonic Industrial Co., Secaucus, N.J., the U.S. arm of Matsushita Electric Industrial Co., Osaka, expects to have products early next year, reports Tony Jasionowski, of the Matsushita Technology Center in Secaucus.

**Write-once.** Hard on the heels of the read-only machines will come the write-once crowd, whose name describes what sets them apart technologically from read-only disks. There's a difference in price, too, evidently: they sell for anywhere from $500 to $800 for a 100-megabyte, 5¼-in. disk being developed for personal computers by Information Storage Inc., Colorado Springs, Colo., to $45,800 for the Hitachi library subsystem.

The Sugart Associates division of Xerox Corp., Stamford, Conn., which is sharing technology with Thomson-CSF, Paris, says it has been shipping sample quantities of a 12-in., 1-gigabyte drive to OEMs. It expects to be in volume production by the end of this year.

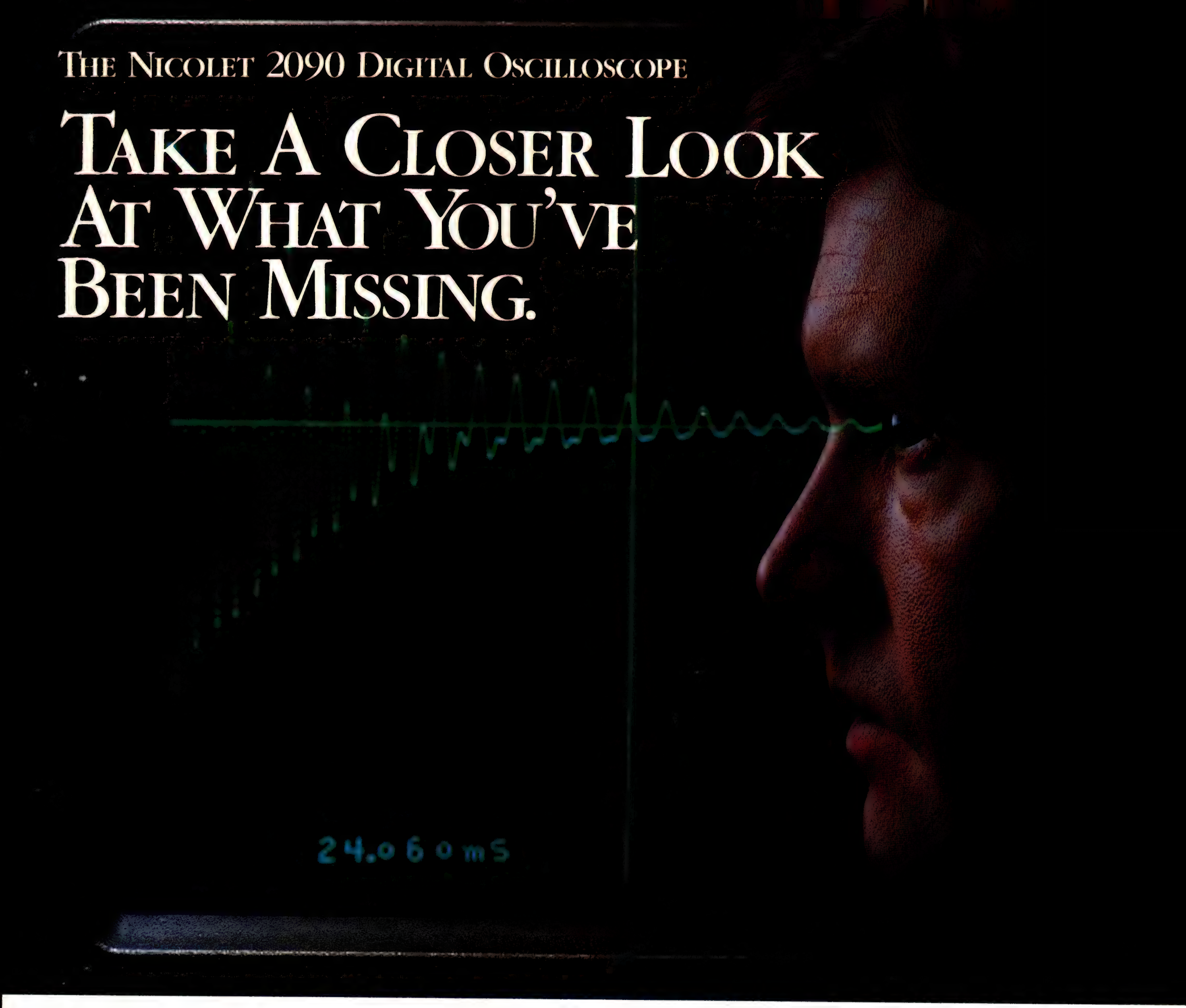
Hitachi introduced its write-once 301 series at the 1983 National Computer Conference. But delivery still takes five to six months because

## The search intensifies for an erasable disk

Largely because of work done for fiber-optic communications, laser diodes have been improved to the point where read-only and write-once disk systems using 820-nm lasers are about to become mass-produced items. Some research is still underway to develop lasers with shorter wavelengths and thus smaller writing spots, but now the main goal in optical-disk technology is finding a medium for erasable disks. Research is being pursued along two parallel tracks. One approach—that favored by Matsushita, Storage Technology, Sony, and Hewlett-Packard—is based upon inducing a phase change in the active layer of the medium. By varying the heat applied to the active layer, it should be possible to control the reversal between amorphous and crystalline states. The relative reflectivity of these two states provide the ability to read, but the question many observers are asking is: how long can the medium be subjected to temperatures between 500°C and 1,000°C before failing?

The other approach to erasing optical disks, with which at least 13 companies are active in research or development, is based on magneto-optics and utilizes techniques similar to those employed in vertical magnetic recording, itself still an experimental technique. In magneto-optical, the active layer of the disk is uniformly magnetized in a direction perpendicular to the plane of the substrate. In that state, a temperature increase of only 100°C to 200°C will demagnetize the area heated by the laser spot because of the Curie effect.

Then a magnetic coil, working with the modulated laser beam, can reverse the polarity of magnetization in the submicrometer spot. This effectively writes data into the disk, because the Kerr or Faraday effect partially rotates the polarization angle of a light beam and the rotation can be detected for readout. To erase data, the same steps are performed, except that the demagnetized spot is remagnetized with the original orientation. **–Robert Rosenberg.**



### THE NICOLET 2090 DIGITAL OSCILLOSCOPE

# TAKE A CLOSER LOOK AT WHAT YOU'VE BEEN MISSING.

## DIGITAL PRECISION AND RESOLUTION LIKE YOU'VE NEVER SEEN.

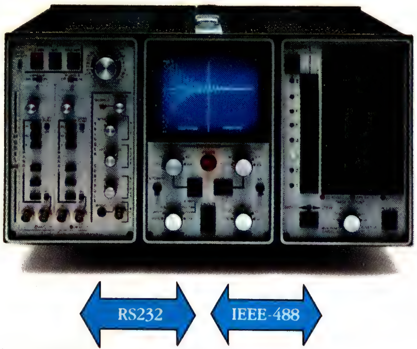
Picture this. The smallest detail in *12-bit resolution,* expansion to X64, with voltage and time coordinates alphanumerically displayed. Plus the ability to record 4K data points at *speeds up to 50MHz,* with the 205A plug-in. It's what you'd expect from the digital oscilloscope that's still setting the standards—Nicolet's 2090.

## DON'T MISS ANY TRANSIENTS.

The 2090 offers push button transient capture, at speeds selectable from 20 nanoseconds to 200 seconds per point, so you can record fast or slowly changing signals with ease. And *pre- and post-trigger capture* lets you see what led up to an event as well as what followed. Built-in floppy disk allows unattended operation . . . just set and forget.

## THE VERSATILITY YOU'VE BEEN LOOKING FOR.

Optional RS232 and IEEE-488 bidirectional interfaces give you the ability to coordinate and manipulate data by remote computer. That means the 2090 scope can be the front end of an entire analysis system. Not only that, the 2090's modular design allows you a choice of *four different plug-ins.* Pick the digitizer that's designed for your present application, and add other plug-ins to fit your expanding needs in the future.



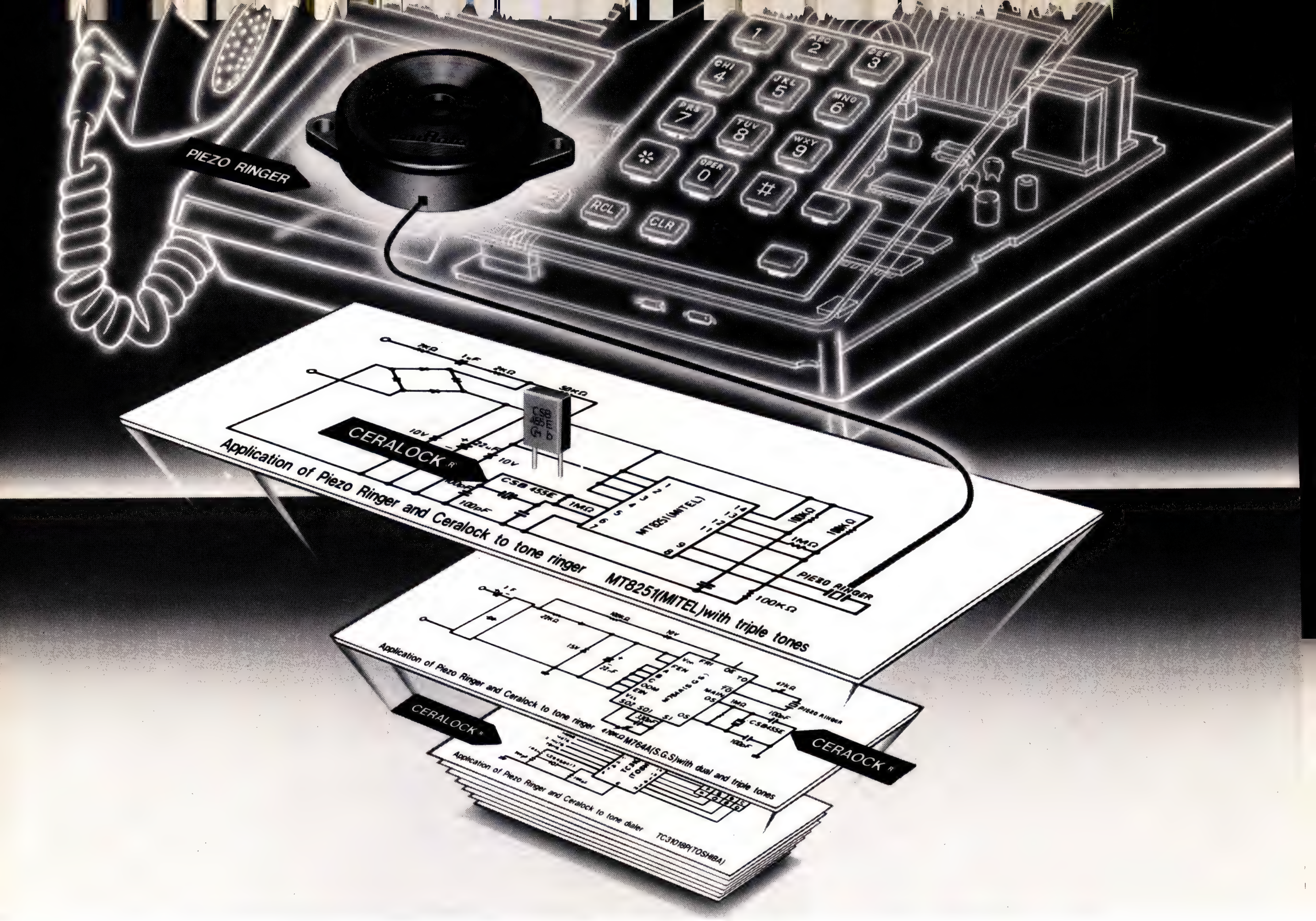
## SEE FOR YOURSELF.

Let us show you how easy the 2090 is to use. It's time *you* started benefiting from the tremendous digital advantage. Call us: **(608) 273-5008.** Or write: Nicolet Oscilloscope Division, 5225 Verona Road, Madison, WI 53711.

**BRINGING DIGITAL PRECISION TO AN ANALOG WORLD**

**NIC Nicolet**

For more information circle #21

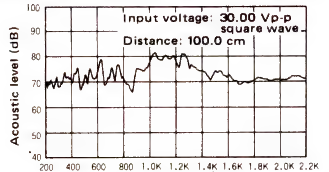

PIEZO RINGER
CERALOCK®
Application of Piezo Ringer and Ceralock to tone ringer MT8251(MITEL)with triple tones
PIEZO RINGER
100KΩ
Application of Piezo Ringer and Ceralock to tone ringer M764A(S.G.S)with dual and triple tones
CERALOCK®
CERAOCK®
Application of Piezo Ringer and Ceralock to tone dialer TC31018P(TOSHIBA)

TELE COMMUNICATIONS USE LOW-FREQUENCIES

# PIEZO RINGER—WITH CIRCUIT DESIGN TECHNOLOGY FOR CREATING THE MILDEST TONE POSSIBLE

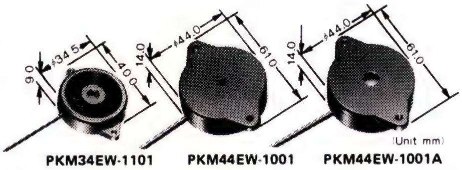
Murata has made the best use of its original ceramic technology to produce the PIEZO RINGER, a thin device for telephones that gives off a mild tone. The PIEZO RINGER perfectly meets the needs in all low-frequency communication equipment—such as in electronic telephones, car telephones and cordless telephones. And with its PIEZO RINGER and ceramic resonators, Murata also provides useful circuit designing techniques to help you use them as easily and efficiently as possible.

**Frequency characteristics of model PKM34EW-1101**



**Specifications of model PKM34EW-1101**

- Acoustic level: 70 dB min. at 1m, 30 Vp-p, 1.1 kHz square wave
- Effective input: 40 Vp-p max.
- Operating temperature range: −20° to +70°C
- Storage temperature range: −30° to +80°C



(Unit mm)

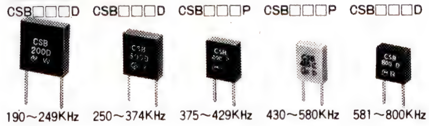
PKM34EW-1101 PKM44EW-1001 PKM44EW-1001A

## CERAMIC RESONATOR CERALOCK®

Ceralock® is available in a wide variety with a reference oscillation frequency range of 190KHz to 30MHz for microcomputers. Each type is compact, lightweight, highly resistant to shock and stable in performance in extreme temperatures. Oscillation circuits incorporating Ceralock®, transistors and ICs need no adjustment. All Ceralock® can be delivered taped-and-reeled to match automatic insertion specifications.

**■ CSB Series**

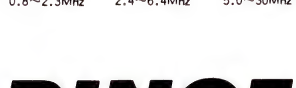
CSB□□□D CSB□□□D CSB□□□P CSB□□□P CSB□□□D



190〜249KHz 250〜374KHz 375〜429KHz 430〜580KHz 581〜800KHz

**■ CSA Series**

CSA□□□MK CSA□□□MG CSA□□□MS/MT/MX



0.8〜2.3MHz 2.4〜6.4MHz 5.0〜30MHz

●In addition, MURATA also provides a variety of its other original electronic components for all telephone requirements.

| Uses \ MURATA's products | Piezoelectric · buzzer/speaker | Ceramic filters | Micro-chip components | "CERACON"® | Monolithic "CERACON"® capacitors | EMI filter "EMIFIL"® | Trimmer capacitors | "POSISTOR"® | Potentiometer | Semi-fixed variable resistors | R networks | Varistor-type barrier-layer capacitors | Hybrid ICs | Microwave filters |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Electronic Telephone | ● | | ● | ● | ● | ● | | ● | ● | ● | ● | ● | ● | |
| Car Telephone | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● | ● |
| Cordless Telephone | ● | ● | ● | ● | ● | ● | ● | | ● | ● | ● | ● | ● | ● |

**muRata ERIE**

MURATA ERIE NORTH AMERICA, INC.……Phone:404-953-1799 Telex:542329
3002 Kingston Court, S.E., Marietta, GA 30067, U.S.A.
MURATA ERIE NORTH AMERICA, INC. CHICAGO OFFICE……Phone:312-297-5560 Telex:281009
MURATA ERIE ELEKTRONIK GMBH (West Germany)……Phone:0911-66870 Telex:623763
Kreuzsteinstr, 1A D-8500 Nürnberg 52, West Germany
MURATA ERIE ELECTRONIQUE S.A. (France)……Phone:024-6767 Telex:699954
MURATA ERIE ELETTRONICA S.R.L. (Italy)……Phone:688-4833 Telex:330385
MURATA ERIE ELECTRONICS (UK) LTD. (England)……Phone:2514-28585 Telex:858971

**muRata**

MURATA MFG.CO.,LTD.

HEADQUARTERS 26-10, Tenjin2-chome, Nagaokakyo, Kyoto 617…Phone:075-921-9111 Telex:64270 MURATA J
MURATA ELECTRONICS SINGAPORE (PTE.) LTD. (Singapore)……Phone:2554233 Telex:21127
TAIWAN MURATA ELECTRONICS CO., LTD. (Taiwan)……Phone:042-91-4151 Telex:11348
(Taipei Office)……Phone:02-562-4218
MURATA COMPANY, LTD. (Hong Kong)……Phone:0-262099 Telex:56208
MURATA MFG. CO., LTD. Seoul Branch (Korea)……Phone:720-7605/720-7321 Telex:25858

**For Telephone PIEZO RINGER**

Circle 100 on reader service card

"each part is almost hand-made. [We are] still working on production techniques to get to full automation," says Paul Ogawa, a sales manager at the OEM divison in Lyndhurst, N.J.

Using a 12-in. disk that can store 1.3 gigabyte on a single side, Hitachi is showing two systems. Panasonic, which started delivering its 8-in., 700-megabyte optical memory disk system to OEMs last year, expects to be geared up for quantity shipments in 1985. By then, Optical Storage International, Santa Clara, Calif.—the partnership formed by Control Data Corp. of Minneapolis and N.V. Philips—will be delivering their 12-in., 1-gigabyte LaserDrive 1200.

**Erasable.** Last to come will be the erasables (see "The search intensifies for an erasable disk," p. 20). Edward S. Rothchild, publisher of *Optical Memory News,* San Francisco, reports, "I expect to see between one and three erasable optical memory products introduced by such firms as Matsushita and Sharp timed to coincide with the Expo 85 show [from March 17 to Sept. 16] in Tsukuba, Japan."

**–Robert Rosenberg**

## ARTIFICIAL INTELLIGENCE

# Uncertainty over commercial appeal doesn't faze new entrants, investors

**Austin, Texas**—The conclusion of the largest artificial-intelligence gathering ever held has left researchers, major computer firms, and investors still wondering if emerging AI technologies can make a lot of dollars and sense in commercial markets. But a growing number of them are clearly willing to give it a try, as industry projections place AI market potential at nearly $3 billion by the start of the 1990s.

"This little gathering has certainly changed," noted Woodrow Bledsoe, incoming president of The American Association for Artificial Intelligence. The AAAI hosted its 1984 conference, the largest AI gathering ever held, in early August at the University of Texas.

A number of companies—such as IBM, GM, Ford, Texas Instruments, RCA, North American Philips, and General Dynamics—were openly wooing academic leaders at the conference. The rush to hire talent has caused some observers to express concern over the future of university-based AI research.

"I do not really worry about all the venture capitalists running around here now. My only concern is that it does not become a distraction for the researchers," adds Bledsoe, referring to the scramble to hire AI scientists for labs at major industrial and electronics corporations.

On leave of absence from the University of Texas, Bledsoe is now also heading up AI work at Microelectronics and Computer Technology Corp. (MCC), the industry research and development consortium in Austin.

**Technology transfer.** Weighing heavily on the minds of the attendees, however, was the ticklish task of transferring AI from the laboratory to the product portfolio. A majority of the booths on the show's crowded exhibit floor highlighted expert-system development tools, the fastest emerging AI form today, which are just beginning to hit the market as products. Expert systems are packages intended to mimic human experts by making inferences from knowledge stored in data bases.

Expert-system shells, empty data bases ready to be filled with knowledge from human experts, are seen by many as the next step in AI product evolution. "They are the next rung in the development ladder aimed at specific business and industrial markets," says Larry Geisel, president of Carnegie Group Inc. of Pittsburgh, Pa.

Geisel believes the proliferation of expert-system development tools on the market—such as his firm's SRL+ integrated knowledge-engineering environment—results from a shortage of AI personnel. By 1987, he expects to see ready-to-use expert systems on the various commercial markets. Today, expert systems are built on a custom basis, he adds.

**Fumble worry.** A top concern is that a bad handoff between research labs and product-development teams could be a stumbling block for AI, suggests MCC chairman B.R. Inman, who tracked the conference from his headquarters office in north Austin. Inman believes AI technology will prove to have a wide-reaching impact on parallel processing, human interfaces, computer-aided design systems, and software.

In addition, he says it is also likely to show up in specific market niches. MCC, for example, is working on knowledge-based expert systems for CAD, which will act as an interface buffer between designers and "bright young programmers writing code," Inman says.

"I worry that a premature expectation of marketable AI products may lead to some early disappointment, simply because there is no quick return for venture capital," says Inman, adding that within a decade knowledge-based expert systems will exist throughout the commercial and military marketplace. "I have got great confidence [in the use of AI], which is soundly based because we have been using expert systems in defense for a long time," notes the retired U.S. admiral and former deputy director of the Central Intelligence Agency.

Speaking before the conference's session on the subject of technology transfer to commercial markets, Syntelligence Inc. president Peter E. Hart said, "The AI community has a very good track record of 20 years in the development of very fast hardware and software tools for itself. But we have very little experience in developing and delivering end-user applications. And yet, as far as the rest of the world is concerned, we will be judged in a practical sense by how well we can deliver applications to end-users."

Syntelligence, Menlo Park, Calif., is pursuing such a goal by developing expert systems for the insurance industry. As with any emerging field, Hart believes AI is up against competing technologies. "For example, the collection of menu-driven systems and fancy help systems [such as icon-oriented operating systems] have offered solutions which earlier might have been served by [AI] natural-language front-ends."

Much of the product definition difficulty centers around the paradoxical nature of intelligence itself, believes Beau Sheil, manager of AI systems products at Xerox Corp.'s Palo Alto Research Center who also participated in the conference's panel discussion on technology transfers.

"The definition of intelligence is intellectual capability that you do not understand. Therefore, the lack of understanding will be a basic problem which will continue to occur," cautioned Sheil, who estimates it "takes about four or five years to successfully introduce AI into each application into the field."

"When you make a major introduction in the technology, you must describe the product with such terms as rule-based, guessing, trying and backtracking. That does not inspire confidence," Sheil joked before the group. **–J. Robert Lineback**

## AI SOFTWARE

# Grouping software to fit many needs is called key to marketability

**Los Angeles**—For all the fanfare surrounding expert systems—those first practical applications of computer artificial-intelligence research that employ chip-embedded expertise to aid decision making—producing equipment that works satisfactorily is proving difficult. Even the firms that make the specialized hardware seem to be backing off on their claims for these problem-solving systems.

This calls for a new approach to the cost and complexity of expert systems, say executives at Silogic Inc., a Los Angeles firm that designs and markets expert-systems software. They tested the waters on this subject at the recent meeting in Austin, Texas, of the American Association for Artificial Intelligence with informal discussions about their bundled software package, which is dubbed the Knowledge Workbench.

**Confluence.** What Silogic offers is a one-package combination of what it feels are the three separate pieces necessary for true AI work, explains Alvin Barkovsky, vice president of marketing. Integrated into a single software program are the natural language interface; the knowledge-base manager; and the inferencing engine, which is the heart of AI, since it is the software that makes deductions based on given data. The language used is Silog, the firm's proprietary extension of the high-level Prolog programming language.

Silogic's Workbench has several advantages over the competition, claims Barkovsky. "Because it is the only package we know of that integrates all three elements, the difficulties of melding these components from different vendors do not exist."

Moreover, it is not tied to any specific computer, but is compatible with any machine built around Motorola Corp.'s 68000 16-bit microprocessor family. The rationale for building the first Silogic software package to perform on this class of computer stems from a belief that the next wave of AI development will be rooted in multiuser hardware, rather than the stand-alone personal computers. "We're still looking at this [class of machine], however," says Barkovsky, "and may do something about it later."

**Prototype ready.** Silogic has demonstrated the package in prototype and expects to have it ready as a product later this year for delivery in early 1985. Pricing is still to be decided, although Barkovsky thinks it will be far cheaper than today's AI systems, which start at $50,000.

Besides the basic AI pieces in the Silogic package, the firm adds some specialized software. One is a development environment that includes graphics and windows for creating specific knowledge bases. Another is a universal knowledge-base interface that enables the package to communicate with other knowledge bases.

Designing the Workbench represents a new, more ambitious direction for the firm. Founded in early 1983, Silogic's first products were Prolog software compilers [*Electronics,* Nov. 3, 1983, p. 55]. But Silogic believes the AI market will become "so increasingly competitive that companies offering only pieces of AI software instead of whole packages aren't going to survive," observes Barkovsky. **–Larry Waller**

## ARRAY PROCESSORS

# New chips, projects speed passage of systolic arrays into real world

**Pittsburgh**—As a technique that shows much promise for high-speed digital signal-processing tasks, systolic array processors have been the subject of a great deal of industrial, government, and university research. But the technique has produced little to date in the way of tangible, commercially available hardware.

Now, however, at Carnegie-Mellon University, the concept's originator notes that commercial integrated circuits are beginning to emerge that will make implementation of systolic arrays a much easier task. Furthermore, the Pittsburgh school is embarking on several new federally funded projects aimed at advancing the technique, says H.T. Kung, the CMU researcher [*Electronics,* Oct. 20, 1982, p. 176] who first described the concept in 1978.

**Two for the show.** At this week's 28th Annual International Technical Symposium on Optics and Electro-Optics sponsored by the International Society for Optical Engineering (SPIE), in San Diego, Kung will co-

# Trial & error

## Does this sound like an intelligent way to design a system?

he most costly errors in systems and oftware development today are those hat are usually detected by trial and error. or example, control flow problems that re introduced early in the system levelopment cycle and do not surface ntil the system is built and tested.

After thousands of man-hours of design vork and thousands of pages of locumentation, wouldn't it be comforting o know that your system will perform s required?

Introducing TAGS,™ Technology or the Automated Generation of ystems, developed exclusively by eledyne Brown Engineering.

TAGS is the first automated system esigned specifically for the field of ystems/software development in order to ive computer aided design (CAD) apabilities to the systems engineer. It consists of an unambiguous graphical language called IORL® (Input/Output Requirements Language) and a series of software application packages that automate the system design process, documentation, configuration management, and static analysis of your system specification. TAGS also permits computer simulation code to be generated automatically from the IORL specification which then provides for dynamic analysis, statistical evaluation and the fine tuning of system and application software long before your system is built and implemented —an automated capability never before afforded to the systems engineer.

TAGS gives systems/software engineers what they have needed from the beginning, the ability to finally harness the computer to automate and aid in the design, testing and maintenance of systems. The dramatic cost reduction, accuracy and confidence factors that can be achieved by TAGS hold the promise of revolutionizing the field of systems and software development.

Now you can run your system with infinitely less fear of error.

This most necessary approach to systems/software engineering is available to you today by calling or writing: TAGS/IORL Marketing, 300 Sparkman Drive, Cummings Research Park, Huntsville, Alabama 35807. 1-800-633-IORL. (Toll Free).

TECHNOLOGY
FOR THE AUTOMATED
GENERATION OF
SYSTEMS

T
T A
T A G
**TAGS**
A G S
G S
S

**TELEDYNE BROWN ENGINEERING**

Circle 25 on reader service card

# Squeeze the excess out of circuit board design.

Avoid unnecessary layers in printed circuit boards. Shorten conductor runs. Improve design accuracy.

Let the IBM Circuit Board Design System 2 help. CBDS is highly interactive software that helps you optimize your board designs by automatically handling all the details of a layout as design advances. Even after a designer has worked on a board for hours, CBDS can generally suggest ways to simplify it.

CBDS handles every aspect of board design. You start with a schematic or netlist, and the system helps you create a physical layout. It incorporates a simulator that verifies the logic design, including propagation delay and gate loading, and generates digital test patterns to drive a production-line tester. It creates tapes for photo plotters and numerically controlled production machines. At every step of the process, CBDS automatically insures that you've conformed to your design rules.

### Fewer Layers

You can get a board with fewer layers and drillholes—which means less costly, more producible boards and better yields.

Design output is generated automatically from design data. And system resources can be shared by multiple users, who don't have to be computer experts. CBDS is designed for simplified operation by non-DP professionals.

CBDS, with its complete design-to-manufacturing capability, is competitive in price whether you have a few workstations or many. It works with a range of IBM systems from the 4300 series to the 308X family of processors. And with the IBM 5080 Graphics System workstation, you can work in vivid color.

Make sure your printed circuit boards are the best they can be. For more information about the IBM Circuit Board Design System, call IBM toll free at 1 800 IBM-2468, Ext. 111. Or return the coupon.

CBDS 8/20

IBM
DRM, Dept. BX/111
400 Parson's Pond Drive
Franklin Lakes, NJ 07417

I want to squeeze the excess out of circuit boards.

☐ Please send me more information on the IBM Circuit Board Design System 2.

☐ Please have an IBM representative contact me.

Name____________________________

Title____________________________

Company____________________________

Address____________________________

Phone____________________________

City______________State________Zip________

Circle 27 on reader service card

**TELEX**®

# Telex Shamrock 9250 has everything you want in a GCR tape subsystem. Right down to your favorite color.

It's the color of the money you stand to save with the new Telex Shamrock 9250. The most affordable GCR subsystem in its class.

Telex engineers have been making advancements in GCR technology for over a decade. The Shamrock 9250 is the biggest breakthrough yet. It gives you the faster access and throughput, greater storage efficiency and higher data reliability you look for in a full performance GCR subsystem. And it does so with the kind of cost efficiency other tape drives just cannot match.

**The savings start right up front.** The unit price of the Telex Shamrock 9250 is half that of previous GCR subsystems. Its compact design frees up valuable space. And with the assistance of Telex Engineering experts, your interface development will be fast and efficient.

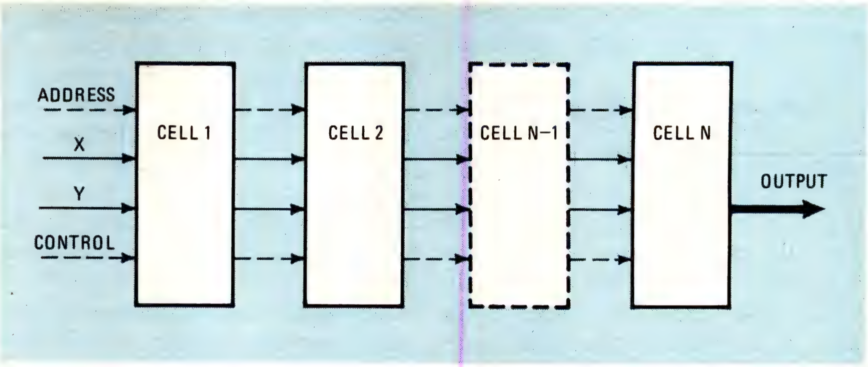
**Down the road, the savings continue to add up.** Cost of ownership of the Telex Shamrock is truly attractive. There are no planned service calls because the 9250 requires no preventive maintenance. Self-calibrating capability eliminates the need for scheduled adjustments. When service is required, the resident diagnostics hold costs to a minimum. Lower power consumption (typically 100 milliwatt) of the 9250 gate arrays increases reliability and keeps energy costs in line.

There are more reasons why the Shamrock 9250 is today's best value in full GCR performance. For the rest of the story, call your nearest Telex OEM Sales Office or our OEM Marketing Department at 918-627-1111. And let us show you how good you'll look in Telex Shamrock green.

**TELEX® SHAMROCK** ✿ The innovation continues . . .

Telex Computer Products, Inc., Terminals/Peripherals/OEM Products
6422 East 41st Street, Tulsa, OK 74135 (918) 627-1111 **Regional Offices:** Amherst, NH (603) 673-9272/Garden Grove, CA
(714) 898-9833/Houston, TX (713) 497-6770 **International:** (214) 931-8511/telex: 730612 TLXINTL ADDI

Circle 28 on reader service card



**Straight through.** Systolic arrays need relatively little input/output bandwidth because data goes in one end and is pumped straight through to the output at the other end.

author two papers describing CMU work in the field. One will describe results obtained with a prototype array of nine programmable systolic chips (PSCs). It can do two-dimensional convolutions on a video image of 512 by 512 8-bit pixels at the rate of one image every 1.8 s.

The second paper will describe a more ambitious project aimed at producing what Kung, taking a term from the TV show "Star Trek," calls a Warp processor. It consists of 10 board-level floating-point systolic cells plus an output cell and will be capable of 100 million floating-point operations/s. The initial application is in optical navigation for an experimental mobile robot.

**Pump.** Unlike conventional processors, which move data one value at a time through a single processing element where numerical computations take place, a systolic architecture relies on an array of simple, highly regular processing cells. Data from memory is then "pumped" through the cells before returning to memory, much in the same way that blood circulates to and from the heart (hence the name for the technique). The result is significantly increased computation throughput without increased memory bandwidth.

The PSC, which is fabricated in 4-μm n-MOS technology to integrate about 25,000 transistors, has served its purpose in proving the feasibility of the systolic array concept, Kung says. The current nine-chip prototype has been operational for about two months, and Kung plans to build a version using up to 25 PSCs once enough working chips are obtained from the foundry where they are being fabricated.

**Off the shelf.** But the PSC's design is now almost three years old, and during its lifetime, advanced floating-point chips have become available. As a result, CMU systolic array research efforts have now been shifted to design of systolic systems that make use of off-the-shelf chips.

The Warp processor is an example of such a design. Each of its 10 cells will be carried on a 17-by-15-in. board that will contain about 180 off-the-shelf ICs. Key devices to be used include the WTL 1032 and 1033, which are 32-bit floating-point multiplier and arithmetic-and-logic units, respectively, supplied by Weitek Corp., Sunnyvale, Calif. The Weitek math chips will each be supplemented with a WTL 1066 register file chip, which offers six 16-bit wide input/output ports and thirty-two 32-bit registers that will be used for operand buffering.

The Warp is designed as a linear systolic array that takes inputs at one end of the array and produces outputs at the other, with data and control pumped through in the same direction. One beauty of such an array is that minimum I/O is required, since only the two end cells communicate with the outside world. I/O bandwidth with the outside world is typically a major limiting factor for high-performance processors, Kung explains.

As shown in the figure, input to the Warp will include an X channel for feeding in data and a Y channel for carrying the partial results from cell to cell. Outside inputs to the first cell in the array also include address and control lines. "One very important thing in this architecture is that we don't require address generation at each cell," Kung points out.

Rather, address information is fed in at the front end of the array that is used in conjunction with control information also flowing through the array to enable each cell to fetch the appropriate on-board data needed for calculations to be performed. Each cell in the array will carry 16-K bytes of memory for data buffering and table look-up. Based on control bits sent in from the control port, each cell can be reconfigured on every 200-ns cycle by means of a crossbar implemented in each cell using programmable array logic.

Kung expects to have the first board-level Warp cell working by early next year and hopes to have the mobile robot demonstration using all 10 cells ready some time next summer. **–Wesley R. Iversen**

## OPTOELECTRONICS

# Single-tube helium-selenium laser shines with red, blue, green beams

**Bochum, West Germany—**It started out as a laboratory curiosity during the late 1970s at the Ruhr-University, but now the three-color laser seems on its way to becoming a full-fledged product. In a single tube, the continuous-wave, helium-selenium laser emits three beams—red, green, and blue. What's more, it boasts a lifetime of up to 3,000 h.

Jürgen Mentel and Gerhard Schiffner, who head the research team that developed the nascent product at the university's Electro-Optics Department, foresee a variety of applications for it in the printing and graphics industries: exposing color photos, making negatives with high color fidelity, scanning and projecting color pictures, and producing color holographs. It may even eventually find its way into operating rooms, where it could serve as a switchable pilot light in laser surgery.

At present, many of these jobs, if done with lasers, are performed with three-tube systems, which may consist of, say, a helium laser for red, an argon laser for green, and a helium cadmium laser for blue. Because the three-tube systems are necessarily bulky and expensive, researchers around the world, notably in Japan and in the Republic of China, are experimenting with single-tube versions.

In the Far East, work is concentrating on single-tube hollow-cathode type He-Cd lasers. But though these units exhibit an adequate output power, their lifetime is still too low for applications in industry, Mentel maintains.

**Drawbacks.** He concedes that the Bochum unit has limitations, too. For one thing, at 4 mW for each of the three beams, the output is simply too low for some projection and display applications. For another, while the beam quality—that is, the energy distribution over the beam's cross section—is good for the red and green, it is not yet good enough for blue. Further, the noise level is high—5% of root-mean-square output power.

Mentel is confident, however, that his and Schiffner's team can do away with these drawbacks within a year or so. Already, several German companies that manufacture printing equipment and at least one company in the U.S. have shown interest in the Bochum work, and some of them say that they are willing to fabricate the single-tube laser once it is perfected. Outside fabrication would be performed under license from the university.

The Bochum He-Se laser is classified as a cataphoretic metal-vapor laser. Mounted within the laser tube proper is a quartz capillary, about 70 cm long and with a 1.7-mm inner diameter. It is filled with helium at a pressure between 10 and 20 millibars (equivalent to between 7.5 and 15 Torr). The helium is made to discharge by a high-voltage dc power supply.

Selenium vapor is produced from solid, purified selenium in a thermostatically controlled oven that is held at a temperature that ranges between 230°C and 270°C. The vapor enters the discharge near the tungsten-ring anode.

Cataphoresis, an effect that is characterized by the transport of low-ionization-energy selenium ions to the cathode, ensures a nearly uniform selenium distribution in the capillary. On their way to the cathode, the excited selenium ions give off their excitation energy in the form of light.

**Extraction.** Such a cataphoretically operated laser, Mentel says, is a relatively simple source of coherent light. Its construction is only slightly more complicated than that of a helium-neon laser but much simpler than that of a hollow-cathode laser. It generates a multitude of lines, or frequencies, in the visible range. From these lines, a special three-color resonator system (see figure) extracts the three primary colors—red, green, and blue.

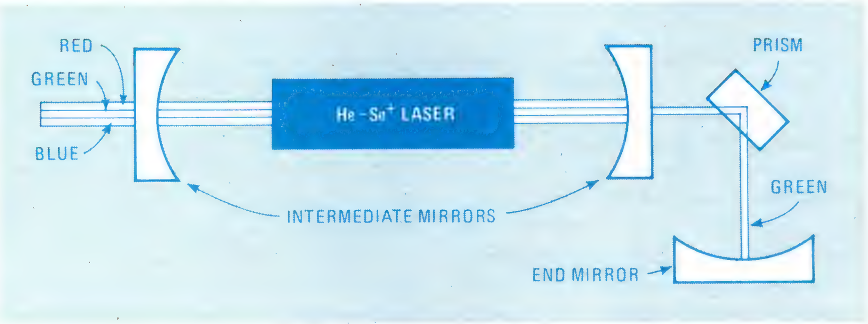
Among the problems that typically reduce the lifetime of an He-Se laser, Mentel explains, are helium losses by diffusion through the hot walls of the capillary and the tube, the condensation of selenium on the Brewster windows at each end, excessive helium consumption by gettering, and cathode contamination by selenium vapor.

"It was only through careful design and workmanship over many years that we solved these life-reducing problems," Mentel says. To begin with, helium losses by diffusion are avoided by making the laser-tube mantle out of a special hard glass—Duram—and by keeping it water-cooled.

To hold down contamination of the cathode, it is positioned far back from the capillary's cathodic end. This construction has a retarding effect on the selenium ions leaving the capillary and prevents them from contaminating the cathode. Separation of capillary discharge, cathode, and condensation zones also help do the job.

The Bochum researchers are currently trying out other design and construction measures in their effort to improve the blue beam's quality and to at least double the output level of each beam to 8 mW. By better control of the discharge process, they hope to reduce the noise level to values well below 5% or the rms output.

–**John Gosch**



**Colorful.** Ruhr-University's single-tube helium-selenium laser uses one external resonator to separate red and blue beams, another for a green beam. These can be mixed to get any color.

## AGRICULTURE

# Robots find jobs down on the farm

**W. Lafayette, Ind.**—Robots checking crop growth, harvesting fruit, planting tissue-cultured seedlings, fumigating, cultivating, or milking will soon become familiar sights on U.S. farms. So maintains Gary Krutz of the Agricultural Engineering Department at Purdue University.

Besides easing the life of the farmer and providing more efficient methods of raising crops and animals, farm automation can be one way to successfully compete with the low-cost imports currently threatening the U.S. agricultural community, explained Krutz in a paper delivered Aug. 15 at the International Computers in Engineering Conference in Las Vegas.

"Research is underway at universities such as Purdue and in industry, but the industries involved are robotics and automation companies, not the traditional agriculture manufacturers," he says. Still, Krutz predicts that farmers will have no trouble accepting robots because computers are already so widespread for management applications such as financial planning and harvest simulations. In fact, the transition to intelligent machines will be easy because most of the agricultural robots now in prototype are controlled by the same personal computers that many farmers are already using.

**Milking profits.** For example, some dairy farmers with herds over 50 head have begun to use electronic transponders to identify the cows. These transponders alert a personal computer to the optimum feed requirements for a particular cow to produce a desired amount of milk. Krutz sees robotic milking as the next logical step.

Martin-Marietta in Orlando, Fla., is developing a robot equipped with small charge-coupled-device cameras mounted in the end effectors. If used for milking, it would get information from the transponder about when to milk. Then, guided by pattern-recognition algorithms stored on a floppy disk, it would sanitize and stimulate the udder.

After the milk was collected, transponders would report on the quantity obtained, and a robot arm would lift the milk container to its storage place. Such a milking scheme not only decreases the number of people involved in the operation but might even allow a dairy farmer to take an occasional day off.

**The right moves.** According to Krutz and his colleagues at Purdue, the actual robotic manipulations—that is, the precision of the end effectors now in production from such manufacturers as Panasonic Industrial Co. and Unimation Inc.—are considered adequate for almost any agricultural work.

In fact, one application for such precision is the very sensitive task of transplanting tissue cultures created by genetic engineering. Krutz sees such cultures (clones of particularly desirable plants) proliferating on farms during the next several years.

"One hand will wash the other," he predicts. "The more tissue cultures there are to be transplanted, the greater the need for precise machines to do the work. Even current-generation robots can transplant seedlings quicker—and almost as delicately—as a human could do it, but they're not used because the vision systems to guide them are still relatively primitive."

**Promising developments.** For some applications that do not involve such precise eye-to-hand coordination, much of the current vision technology is usable. "Color vision can spot fruit that's ripe for picking, " Kurtz says, "while infrared sensors are good at detecting potential sources of disease before a crop becomes infected."

Martin-Marietta's Orlando division, in addition to its work in dairy farming, is developing guidance systems for robot citrus picking. This is an especially promising area from a financial point of view because fruit pickers in Florida are paid as much as $10 an hour—hurting the state's competitiveness with importers from South America. Accordingly, farmers in Florida are seeking to reduce costs by employing robots.

Explains E.G. Tuttle, Martin-Marietta's manager of technology evaluation and transfer, the operation of a prototype robot harvester depends on the reflectance spectrums from fruit and leaves. Green fruit and fruit with serious surface defects reflect less light and can be rejected. Tungsten illumination at 2,500K further enhances fruit reflectance, although lower color temperatures are also acceptable, he says.

In the prototype harvester, a Zilog Z8000 microprocessor processes a photo array of 256 pixels, enhancing fruit and leaf contrast and correlating it with reflectance curves stored in a 65-K dynamic random-access memory. Servo control in the arm is directed by another microprocessor slaved to the Z8000. All control can be located remotely and overridden by the farmer in the field.

Otherwise, adds Krutz, robots can work on their own—round the clock—permitting very intensive cultivation of steadily dwindling farmland. **–David M. Weber**

## COMPONENTS

# Ford recognizes a better idea, joins move to surface mounting

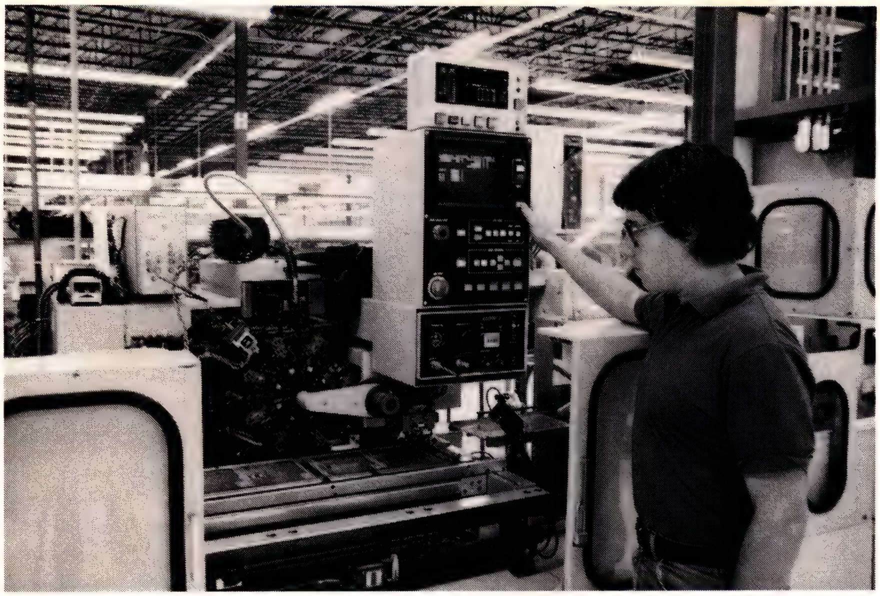
**Markham, Ont., Canada—**Ford Motor Co. next month will receive the first of 29 automated, high-volume surface-mounting machines to be installed at a new 225,000-ft$^2$ plant in this Toronto suburb. With production set to begin next January, Ford will start out using 18 of the special vision-configured SM-3 systems from TDK Corp., Tokyo, and expects to surface-mount some 500 million components during the 1986 model year, says Robert J. Smith, manufacturing engineer in charge of equipment implementation at the plant.

The Ford commitment to surface-mounting technology is the latest affirmation of the packaging revolution that is sweeping the electronics industry [*Electronics,* Feb. 9, 1984, p. 113]. When the Ford plant hits full stride, its production volume will be second domestically only to General Motors Corp.'s Delco Electronics Division operations, in Kokomo, Ind., industry observers agree.

"It's a hell of a big commitment to surface mounting," claims Dennis G. Lex, manager of advanced manufacturing for Ford's Electronics Division, in Ypsilanti, Mich. "We had to build a whole plant around the technology, and we've got more people involved to make sure that we consider every detail than we've probably ever had on any major project."

**Moving to ICs.** Ford's first surface-mountable component types will include chip capacitors, chip resistors, and transistors in small-outline packages, but the auto maker expects to move to surface mounting of integrated circuits within one to two years after the plant's start-up.

Components will be mounted primarily on standard epoxy-glass printed-circuit boards for use in electronically tuned radios, electronic instru-



**Lined up.** Ford plans to have 18 Japanese-built TDK SM-3 surface-mounting machines—fitted with made-in-the-U.S. vision systems—operating in a Canadian plant by next January.

mentation clusters, trip minders, fuel computers, and other dashboard accouterments. In all, Ford expects its investment in the plant and equipment, including a sophisticated materials-handling system using automated guidance vehicles, to total some $65 million by 1986. The new plant will be operated by Ford Electronics Manufacturing Corp. (formerly Philco-Ford of Canada Ltd.) and will replace an older facility in nearby Don Mills that is based on standard leaded-component technology.

At Allen-Bradley Co.'s microelectronics products business unit, in Greensboro, N.C., marketing manager Jack R. Polakowski says that major commitments from such high-volume users as Delco and Ford are providing a strong base for the growth of the surface-mounted-component industry. (Delco expects to surface-mount 1.3 billion chip capacitors and resistors alone during the 1985 model year, with the number rising to perhaps 1.9 billion in model year 1986.) "And there are other companies that have [plans to use] very substantial volumes on the horizon," says Polakowski, whose firm claims to be the largest domestic supplier of surface-mountable chip resistors.

**Major advantages.** Surface-mounting advantages include reduced size and space requirements along with improved reliability, compared to traditional leaded components. Depending on the application, the use of surface mounting already lowers system manufacturing costs in some cases, Polakowski says.

While components in surface-mounted-packages currently sell for a premium, compared to leaded devices on a part-for-part basis, rising industry volume is expected eventually to tip the balance in favor of surface-mounted parts. In fact, for many discrete components of the kind Ford uses, says Lex, "we expect by next year that the prices will reach the crossover point."

Ford will start out by surface mounting components on only one side of the board, but has the capability to do two-sided surface mounting later. The firm will rely initially on dual-wave soldering equipment from Electrovert Ltd., Montreal. "We've got 47 different boards designed right now to go through the system," notes Lex.

The TDK SM-3 surface-mounting machines will operate initially at a run rate of 9,000 components per hour. Thanks to a joint development effort between Ford and TDK, each machine will incorporate an AV-3 machine-vision system from Automatix Inc., Billerica, Mass. Each machine line will be totally computer-controlled, with human involvement coming only at the repair stations to which boards will be shunted if the vision system spots a missing or misplaced component. Overall plant-control supervision will be handled by a Hewlett-Packard Co. HP-3000 mainframe computer working with the aid of an HP-1000 supervisory computer.

**–Wesley R. Iversen**

## INTEGRATED CIRCUITS

# Siemens single-chip codec filter uses no external components

**Munich**—In its quest to become a major contender in the burgeoning market for integrated circuits for digital telephone exchanges, West Germany's Siemens AG is readying a single-chip, software-programmable, low-power codec-filter combination that achieves high transmission quality with no external components and, thus, with no need for trimming. Called the PEB260, the chip contains some 36,000 transistors and occupies 39.9 $mm^2$ of real estate. The PEB260 codec filter consumes less than 120 mW when it is in actual operation and about 40 mW when it is in standby.

The chip was designed for the line-board architecture proposed by Siemens and Intel Corp., Santa Clara, Calif., for digital exchanges, an architecture that has started to catch on among the world's communications houses. In it, the chip interfaces with the subscriber line circuit on the analog side; on the digital side, it mates with the peripheral board controller. The latter, in turn, then links up with the highways for the pulse-code-modulation transmission and the control signals.

According to Lothar Lerach, manager of telecommunications circuit design and engineering at Siemens' components group in Munich, the PEB260 is functionally similar to the Am701 subscriber line audio processing circuit (SLAC) from Advanced

# TI is making it happen with VHSIC.

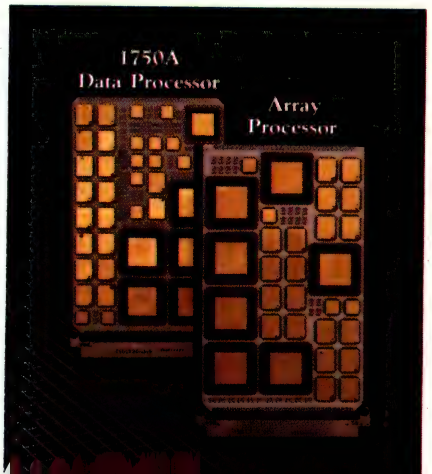
Yes, Texas Instruments is making the future happen now with VHSIC.

The first fully functional 1.25-micron VHSIC chips, operating at 25-MHz over the full military temperature range, have been delivered to the U.S. Army. Functional devices have also been delivered to the U.S. Navy, U.S. Air Force, and Defense Nuclear Agency for test and evaluation.

Current DoD funded insertion programs at TI include Pave Pillar 1750A; ICNIA; ITARS; LHX; M-1 Fire Control; and weapon guidance for IR Hellfire/JSS, TOW 2, and the Launch-and-Leave Glide Bomb. VHSIC technology at TI is also being expanded to include 0.5-micron geometries for application to future autonomous guided weapons for the Army, Navy, and Air Force.

TI is a DoD prime contractor for VHSIC Phase I development, Phase III R&D activities, the Phase II Submicron Definition Program, and is teamed with Intermetrics and IBM for the VHSIC Hardware Design and Development Language (VHD$^2$L) Program.

TI is truly making it happen now with 1.25-micron VHSIC chips and will continue to make it happen through the successful development of the Submicron Development Program.



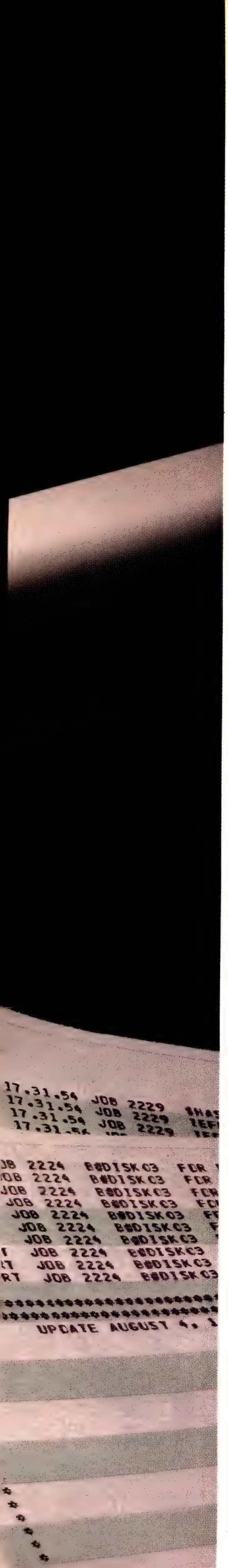
TEXAS INSTRUMENTS

©1984 Texas Instruments

27-3432

# DEC OFFERS EVERYTHING YOU NEED TO BUILD A POWERFUL Q-BUS COMPUTER SYSTEM.

# EXCEPT THIS.



```
17.31.54 JOB 2229
17.31.54 JOB 2229  $HAS
17.31.54 JOB 2229  IEF
17.31.54 JOB 2229  IEF
JB 2224  B@DISKC3  FOR
OB 2224  B@DISKC3  FOR
JOB 2224  B@DISKC3  FOR
JOB 2224  B@DISKC3  FO
JOB 2224  B@DISKC3  F
JOB 2224  B@DISKC3  F
JOB 2224  B@DISKC3
T  JOB 2224  B@DISKC3
RT  JOB 2224  B@DISKC3
RT  JOB 2224  B@DISKC3
****************************
****************************
UPDATE AUGUST 4, 1
```

It's called Cyclone.™ A high-capacity, high-reliability Winchester/tape storage system that's priced to help you blow the socks off your competition.

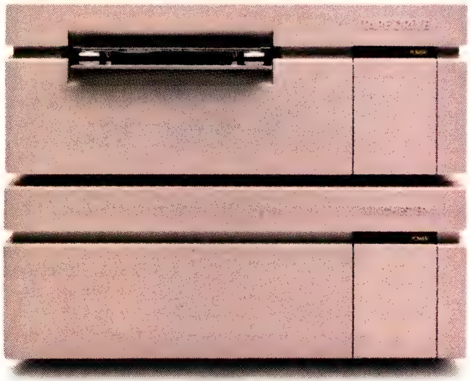
For starters, Cyclone's 5-1/4" Winchester packs formatted capacities from 36 up to 120 megabytes.

So you can sell your Q-Bus based systems (PDP®-11/23, 11/73, MICRO/PDP-11 and MicroVAX) into applications that require large amounts of storage. While providing the lowest cost per megabyte.

But, of course, we couldn't just offer you the highest capacity for the lowest price.

Rather, Cyclone is just what you'd expect from the leader in DEC®-compatible storage.

For instance, its controller takes data off the Winchester at non-interleaved speeds. So your system provides faster throughput.

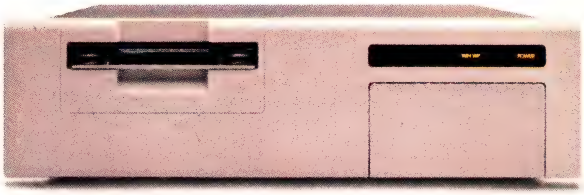


*Our attractive StacPac version can be expanded to include a 6-slot backplane module.*

And Cyclone's access times are twice as fast as a DEC RL02's.

When it comes to integration, Cyclone won't slow you down one bit. It's compatible with DEC's Digital Storage Architecture (DSA), so you don't have to make a single software patch.

Even the 1/4" tape cartridge system is software compatible. It emulates DEC's TSV05/TS-11 so you can run your DEC utilities like BRU, PIP, and SAVRES. Plus it puts a day's work on a single 1/4" tape cartridge. Instead of a supply room full of floppies.



*The ever-popular rackmount model gives you tape and disk storage in one unit.*

Cyclone's good looks also make you look good. For your commercial customers, it's available in our tabletop StacPac™ version. And for scientific or industrial environments, Cyclone is rackmountable.

Finally, Cyclone features HyperDiagnostics,™ the industry's most comprehensive self-diagnostic system. So trouble-shooting's a breeze. And our Customer Service Hotline and Rapid Module Exchange program make it easy for you to keep your customers in business.

To see what Cyclone can do for your Q-Bus system, call the Qualogy sales office nearest you. And watch the competition's socks fly.

**QUALOGY**

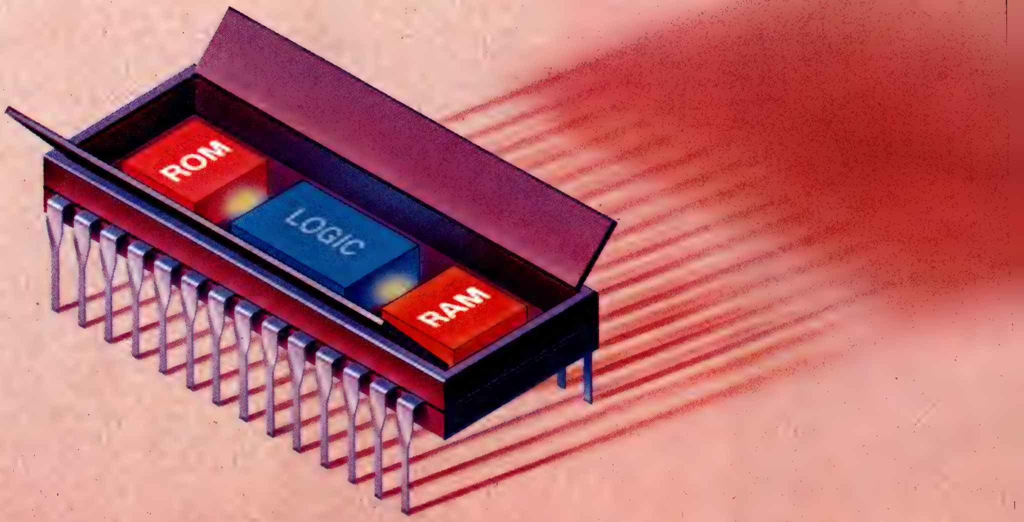
Formerly Data Systems Design

Eastern Regional Sales: Norwood, MA (617) 769-7620. Southcentral Regional Sales: Dallas, TX (214) 980-4884. Northcentral Regional Sales: Chicago, IL (312) 920-0444. Western Regional Sales: Santa Clara, CA (408) 727-3163. Distributors Worldwide. Corporate Headquarters: 2241 Lundy Avenue, San Jose, CA 95131

™Cyclone, StacPac, Rapid Module Exchange and HyperDiagnostics are trademarks of Qualogy, Inc. ®DEC, PDP and MicroVAX are registered trademarks of Digital Equipment Corporation. © 1984 Qualogy, Inc.

**Circle 35 on reader service card**

# ZyMOS Has A New Benefit In Store For Semi-Custom Design.



# Memory.

**Standard Cells.** Your answer to today's semi-custom IC design challenges. And, more importantly, tomorrow's. Now ZyMOS has made semi-custom design more flexible by adding sophisticated memory functions to our proven libraries of CMOS standard cells.

With our new RAM/ROM and compiler, you can custom fit up to 2k-bits of RAM, 16k-bits of ROM, or both, into your application.

All on a single chip.

Our memory cells are already adding greater value and reducing system cost. We have customers using RAM to store telephone numbers in personal pagers. And for on-board error detection. They're using ROM to store microprocessor instructions on the same chip as the logic. And in encoders for storing sync words. We've even delivered memory-based ICs for use in pacemakers.

The applications are almost limitless.

**We Make It Easy.** Because memory is compiled automatically for your application on ZyP,™ our advanced design automation system.

ZyMOS has been at the forefront of semi-custom design for over four years. And it shows in the quality and quantity of our cell libraries. Each element is a fully characterized custom circuit—optimized for maximum performance in a minimum of space.

Our comprehensive libraries offer a wide variety of digital and analog functions. We've also recently added programmable logic arrays—with compiler. Using a PLA is one of the most cost-effective ways of implementing combinatorial logic. Our high-performance 3-micron CHMOS library includes ultra high-speed 75MHz cells and Intel's 80C49 microcontroller. And the libraries can be accessed through ZyPSIN (ZyMOS software on your computer), computer-aided workstations or remotely from your facility. We'll even help with your design.

**And We Guarantee Working Silicon.** Every time. Discover what we have in store for you. Call or write today for more information on our standard-cell design solutions.

ZyMOS Corporation
477 North Mathilda Avenue
Sunnyvale, CA 94086
Phone: (408) 730-5400
TWX: 910-339-9530 ZyMOS SUVL

ZyMOS
PRODUCING THE STANDARD IN CUSTOM VLSI

Circle 36 on reader service card

## Siemens expects big things from Sicofi

With the PEB260 Sicofi chip, for which Siemens AG figures it will have strong second-source allies, the Munich firm aims to corner more than 20% of the world's codec filter market, where fewer than 10 companies now compete.

Rudolf Schwenger, a senior director in Siemens's Munich-based Components Group, puts last year's market at around $55 million and sees it rising to $180 million by 1988 and $320 million by 1993. Europe, he says, accounts for between 33% and 40% of the world codec filter market, a share at least as big as that of the U. S.

The Sicofi, representing the Components Group's most ambitious design project in the communications-circuits field to date, should move into volume production during the second half of 1985. The chip will be discussed at the September 19-21 European Solid State Circuits Conference in Edinburgh, Scotland.

–J.G.

Micro Devices Inc., Sunnyvale, Calif. [*Electronics,* May 5, 1982, p. 113]. Both chips utilize oversampling techniques for analog-to-digital and digital-to-analog conversions, and digital signal-processing methods for the filtering functions.

**Low power.** Being a complementary-MOS design, however, the PEB260 consumes about one third less power than does the n-MOS AMD device. Also, in addition to using no external circuitry, it has just one signal processor in its digital section for filtering (instead of the the two used in the 7901 circuit).

The 7901 is intended for architectures in which a codec filter connects directly to the pcm highway. It therefore is not interchangeable with the Siemens part, which ties to the pcm highway through the board controller.

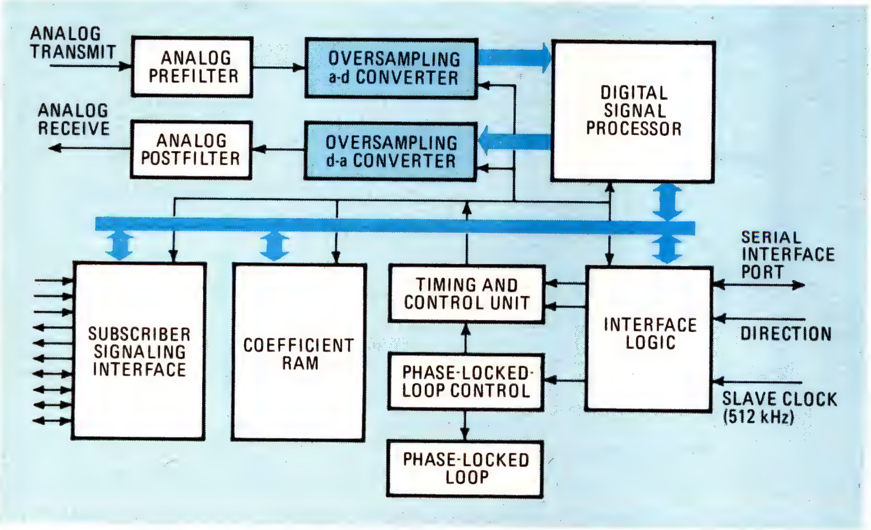
Aside from the standard conversion and filtering chores that are assigned to codecs in digital exchanges, the PEB260 (popularly known as Sicofi—signal processing codec filter—offers users a number of software-programmable functions. They include adjustment of termination impedance, echo suppression, and hybrid balancing, as well as control of level and correction of frequency response. Traditionally, these functions have been performed by discrete external networks, explains Dieter Vogel, the manager of the Sicofi project.

The Siemens designers obviated the need for external components with several measures: For one thing, the system derives the clock signal for the PEB260 from the peripheral board controller, incorporating on the chip a phase-locked-loop circuit for generating a 4.096-MHz clock for the signal processor's arithmetic and logic unit; this does away with an external quartz. For another, it puts all analog functions on the chip, eliminating any need for external components that must be trimmed. Finally, it uses on-chip TTL-compatible driver circuits.

**Resolution.** Oversampling performed at 128 KHz—16 times higher than the basic 8-KHz pulse-code-modulation sampling rate—achieves fine resolution by averaging over a large number of coarse quantizations. This approach depends on the fact that there is a correlation between the sampling rate and the necessary accuracy of the conversion. The advantage of this technique is that it works with fewer components than do circuits that accomplish coding by successive approximation, which is the method used in some codec filters (such as Intel's 29C51 part). Successive approximation calls for a large amount of precision analog circuitry.

The Sicofi uses signal processing methods for filtering because such methods, unlike switched capacitor filtering employed in some competitive devices, allow filter performance to be predicted, make the device less sensitive to parameter changes, and provide for low crosstalk.

All filtering, project manager Vogel stresses, is performed by just one processor: a dedicated signal processor with scale and add arithmetic. To ensure stability, overflow detect and correct logic added to the arithmetic and logic unit, performs front- and rear-bit chopping. **–John Gosch**



**Self-contained.** Siemens' Sicofi circuit handles analog-to-digital and digital-to-analog conversions by oversampling techniques. A single digital signal processor performs all filtering.

## MANUFACTURING

## Smart carts tackle in-plant tasks

**Palo Alto, Calif.**—As yet, there are very few flexible, reprogrammable robot vehicles plying the aisles of the nation's shops and factories. But the need for low-cost smart carts is a necessity that's mothering considerable invention [*Electronics,* March 22, 1984, p. 54].

At the Smart Product Design Center of Stanford University, for example, a group led by former graduate student Steven Formisani has constructed an optically guided smart cart. Built with off-the-shelf components, the cart stands a good chance of making its way into industry.

Formisani, now a staff engineer at AT&T Bell Laboratories, Holmdel, N.J., reported on the Stanford vehicle last week at the Computers in Engineering meeting of the American Society of Mechanical Engineers in Las Vegas. Tektronix Inc. funded the project, which resulted in a cart designed to deliver printed-circuit-board components to assembly stations along a set track.

The Beaverton, Ore., instrument maker sees considerable promise in the smart cart, which can be controlled from anywhere along its route. But company spokesmen say no specific new products are imminent.

**Forthright.** Although it was designed with a specific application in mind, the cart has a highly adaptable on-vehicle control system, Formisani points out. To ensure flexibility, the Forth programming language was chosen as the control system's resident software, because Formisani feels it is an ideal high-level language for process-control applications. The Forth kernel—operating system, compiler, interpreter, and word set—resides in less than 8-K bytes of memory, which leaves plenty of memory space for mechanical functions such as obstacle avoidance.

What's more, Forth allows a user to develop a vocabulary unique to a particular application. The user has direct access to all memory locations and input/output ports and can quickly isolate and debug a given sequence of instructions, because each program routine can only contain previously defined words. When the instructions have been downloaded from one or more work stations to the vehicle, a random-access-memory image will continually update the vehicle's operating commands through a comparison of the cart's planned and actual path.

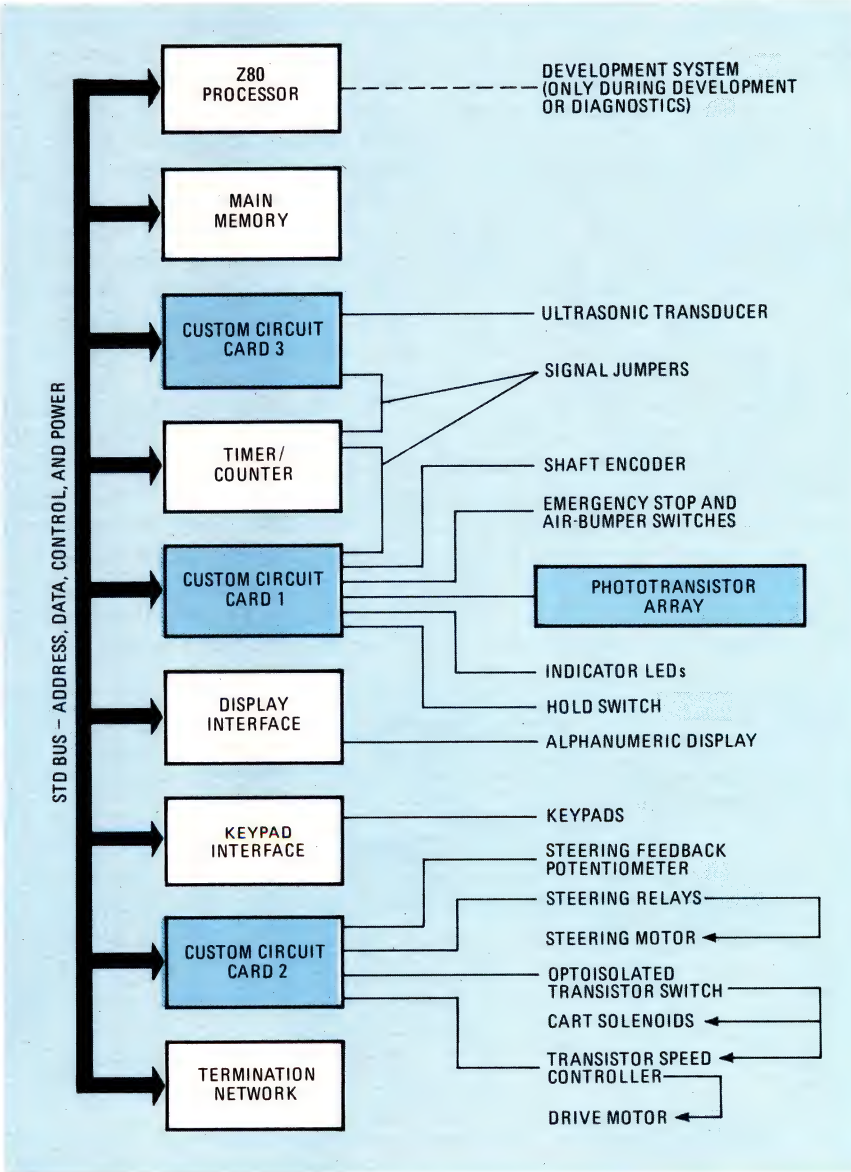
**Easy tracking.** The simple track consists of a reflective tape that can easily be pulled up and repositioned for a different pattern when the delivery sequence changes.

The actual motion sensing is accomplished by the cart "seeing" the tape path with an array of 16 phototransistors. An incandescent light mounted above the array illuminates the tape track and floor. When the phototransistor output is gated through Schmidt triggers, differences in reflectivity between track and floor are broken down to a binary pattern. This signal is read as 2 bytes through tristate buffers.

A signal-processing algorithm analyzes the reflected light in terms of two transitions: between each edge of the tape and the floor. If no transitions are found between floor and tape, the lateral position of the cart is considered valid, unless the user presets more than two transitions in order to account for tape segments that might have been removed or soiled.

"This system is more robust than most, because the cart will continue forward in an attempt to pick up the desired two-transition edge rather than stop in its tracks at the first sign of a break in the tape," Formisani says. Of course, the user can also program the vehicle to stop at any point where it detects a difference in reflectivity.

**Off-the-shelf.** The user interface is built around a Z80 microprocessor and an STD Bus consisting mainly of off-the-shelf cards. The cards can be configured into larger circuits that the customer will probably be able to modify for his own specialized appli-



**User's choice.** Readily available components make circuits for the vehicle's operation and control flexible. Peripheral interconnections can be modified easily according to application, and the Forth language allows the user to define program steps.

# For the manager who is serious about improving product quality and lowering production costs...

---

## HP introduces the Q-STAR network

Move into the age of computer integrated manufacturing with HP board test systems and HP's exclusive Q-STAR network.

Q-STAR (Quality Systems for Test, Analysis and Repair) is an integrated approach to solving your manufacturing test problems when your requirements call for more than just a test system. Analysis of the test data provides information you can use to solve your manufacturing process problems.

With the HP 3065 Board Test System, you can test your complex analog/digital PC boards. HP's Q-STAR network gives you detailed process data to help fine tune your entire manufacturing and assembly process. You can use this information to smooth out your production process as well as greatly increase your product quality. Use Q-STAR to identify chronically bad parts and subassemblies. Search out the weaknesses in the build procedure. Minimize product rework. Control production costs and boost product quality by maintaining tighter, more informed control of the production cycle.

In addition, HP paperless repair software provides automation of your repair process, speeds the repair and provides insight into what actually happened, permitting rapid identification of subtle manufacturing process problems.

### Improving Product Quality.

With HP's Q-STATS and paperless repair software (part of the overall Q-STAR system), you can get management, utilization and process yield reports to help you reduce inventory and improve your process. To provide a total solution to your testing problems, HP offers this capability as a standard no-charge feature of the HP 3065 Board Test System. Plus, by taking advantage of Q-STAR's compatibility with HP's much larger Manufacturer's Productivity Network (MPN), you have a powerful set of tools for increasing product quality.

### Lowering Production Costs.

The HP 3065 Board Test System provides the highest throughput possible today. That means your test backlogs become significantly reduced. Get your new products into production faster with the new HP CAD-VANTAGE software. A vital component of the HP Q-STAR network, this software automatically links any CAD database to an HP 3065, freeing you from laborious manual entry of board topology. Once your CAD data is transferred, HP's advanced IPG-II test program generation package lets your engineers produce efficient test code. For greater responsiveness to increasing production schedules, each HP 3065 controller can support up to six configurations including three test heads, six development and repair stations, or a combination of your choice.

With the HP Q-STAR network, you can improve product quality while lowering production costs.

Hewlett-Packard provides a complete line of board test systems, featuring a wide selection of capabilities and prices to satisfy most production test applications. To find out more, contact your local HP field office listed in the telephone directory white pages. Ask for the electronic instruments department.

**hp HEWLETT PACKARD**

Circle 39 on reader service card

0901404

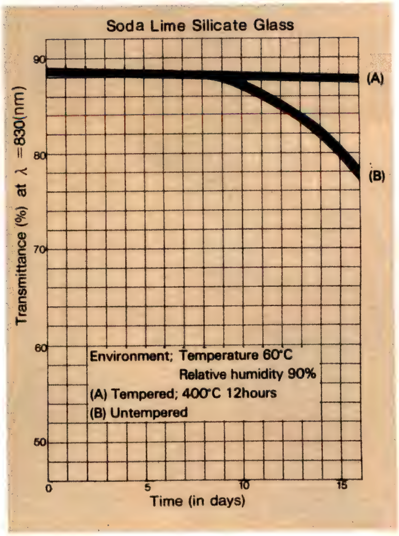
Common Sense Challenged!
Can You Break Glass ?

## Less brittle and Chemically stable
## The best Storage Disc is made of Chemically Tempered Glass

**HOYA**
ELECTRONICS

One must disregard, however difficult, the preconception that glass is fragile. Hoya's chemically tempered glass, polished with very high precision, is stronger and does not deform even at high speed of rotation; and it is also less susceptible to chemical change caused by sodium ions.

The Hoya glass disc can be stored for a long time without deterioration. Initial bit error is also reduced. Glass is ideally suited to long-life storage discs.



- ● SAFE ROTATION SPEED ·· 12000r.p.m
- ● SAFE BENDING ············ 34.4kg/mm$^2$
- ● DEPTH OF COMPRESSION ··············· 15$\mu$m
- ● SURFACE ROUGHNESS ···················· 50Å
- ● PARALLELISM ··························· 20$\mu$m
- ● CONCENTRICITY ························ 50$\mu$m

**GLASS DISC**

### HOYA CORPORATION

**ELECTRONICS DIVISION**

**Sunnyvale Office**
1237 Midas Way, Sunnyvale, CA 94086
Phone (408) 737-8151 Telex:172410

**London Office**
Bilton House, 54–58 Uxbridge Road, Ealing, London W5 2TL
Phone (01) 579-6930/6939 Telex:895107 HOYAELG

**Tokyo Office**
2-7-5 Nakaochiai Shinjuku-ku, Tokyo 161
Phone (03) 952-1151 Telex:2323111 HOYA PHJ

Circle 40 on reader service card

cation. "Substantial savings are realized by using off-the-shelf hardware," says Formisani, "and greater flexibility is achieved when the customer has ready access to spare or additional cards."

In addition, the use of an electrically erasable programmable read-only memory lends itself to easier system programmability, because any reprogramming can be accomplished in circuit. The length of the track, number of work stations, and amount of time the robot vehicle spends at each work station are all variable—even during a manufacturing operation—and are therefore written into the EEPROM during the teaching sequence. Thus, it is not necessary to pull the memory from the vehicle in order to reprogram its functions. The reprogramming is accomplished electrically at the work station. **–David M. Weber**

### TRADE

## California group to push exports

**Sunnyvale, Calif.**—Seeking to stimulate export trade by its member companies, the Electronics Association of California is entering into a working agreement with BankAmerica World Trade Corp., a bank-held export trading company. The agreement will enable association members to work with the trading company in foreign markets.

Export trading companies are recent creations stemming from a relaxation of antitrust laws in foreign trade as a result of the Export Trading Act of 1982. Under the agreement, the EAC will coordinate a program of export marketing support to its approximately 600 small- to medium-size member companies.

"This agreement will allow our member companies to improve their competitive position in international markets by combining their marketing strategies under an ETC [export trading company]," says EAC president James J. Conway. "Adding a banking partner provides financial stability to their export operations and provides them with new and influential worldwide business contacts."

ANNUAL IMPORTS/EXPORTS OF ELECTRONIC PRODUCTS
(BILLIONS OF DOLLARS)

| Year | Imports | Exports | Trade surplus (deficit) |
|---|---|---|---|
| 1980 | 13.3 | 20.1 | 6.8 |
| 1981 | 18.7 | 23.5 | 3.9 |
| 1982 | 21.0 | 24.3 | 3.2 |
| 1983 | 27.6 | 26.7 | (0.9) |

SOURCE: ELECTRONICS ASSOCIATION OF CALIFORNIA

The need for increased U.S. electronics exports is unquestionable, according to Conway. Citing the fact that last year for the first time the U.S. had an $875 million trade deficit in electronic products (see table), Conway says, "I think this is something everyone has to focus on."

**Important roles.** Bank-held trading companies can play a large role in foreign trade, because they have the direct financing of the major banks supporting them. BankAmerica World Trade president Peter M. Nelson notes that "the government is now permitting the financial resources of the country to be brought to bear [in world markets]."

The EAC program will include the coordination of meetings between the trade corporation and electronics companies, as well as educational sessions in which officers from companies already involved in foreign markets can impart export know-how to those with no such experience. In addition, the trade corporation will introduce the export neophytes to foreign contacts.

The six-month-old BankAmerica World Trade Corp., a subsidiary of BankAmerica Corp., has offices in Hong Kong and Beijing, China. It will expand to Singapore, Tokyo, and Europe by year-end.

Working through the trade corporation and these foreign sales offices, electronics companies will be able to effectively reach new foreign markets, officials say. The trade corporation can be as much or as little involved as a company chooses.

**Many services.** Among the many services BankAmerica World Trade Corp. can perform are market research, product marketing, barter transactions, distribution, freight forwarding, and insurance. In addition, it is prepared to take title to products for resale, says Nelson.

Summing up the importance of his association's agreement, Conway says: "An export trading company significantly reduces the complexity, expense, time, and effort involved in overseas marketing, which previously made it difficult, if not impossible, for many companies to develop these markets." **–Eve Bennett**

### TRANSPORTATION

## Computer, radio net exercise control over municipal transportation

**Turin, Italy**—In a development that it is hoped will lead to significant improvements in Italian urban transportation, the municipal transport authority of this northern industrial city will experiment with a novel electronic control system aimed at getting its buses and streetcars running on time. The Turin experiment will be used to showcase the scheme to other major Italian cities and possibly to the international market as well.

The pilot project will be carried out by Sistema Informativo del Servizio, a consortium consisting of Italtel Società Italiana Telecomunicazioni SpA, Azienda Tranvie Municipali (Turin's municipal transit authority), and Mizar Automazione SpA, a software consulting firm. In the project's initial phase, some 200 vehicles will be equipped with the system by the end of next year. Extension of the scheme to all of the city's vehicles, which is expected to take place about six months later, will bring the total cost of the program to an estimated $6.5 million.

**Movable fleets.** The SIS system is a computer-controlled radio mobile network with dynamic reconfigurable polling on a data-polling channel and random access to other radio-frequency channels for data transfer and voice communications. It provides integrated communications for the supervision and control of mass-transit fleets that can be interfaced with urban traffic control systems, such as those governing traffic lights and other signals.

The system architecture is divided into three different subsystems: mobile terminals installed in the vehicles, channel management units distributed throughout the city, and a central system management and data elaboration center. Although many of the details are still being worked out, particularly with regard to the hardware to be used on the vehicles, the consortium says the general operational scheme has already been well defined.

The vehicle terminal will consist of two Eurocards and is based on the Z80 microprocessor. Its principal function will be transceiver management of, for example, rf channel access and scanning, input/output management, polling procedures, and the handling of external sensors that furnish the unit with information, such as the number of wheel revolutions, vehicle speed, and the number of door openings. Based on this information, the terminal can calculate its approximate position by statistically interpolating the data with information characterizing the vehicle's route stored in its memory.

As a backup measure, the system may integrate proximity sensors on routes to avoid major errors in estimation. These sensors, which would transmit data on the same channel frequencies as the mobile terminals, would also signal vehicles when they are passing by.

Communications from vehicles to the central system are carried out by way of channel-management units distributed throughout the area covered by the fleet. These units provide one interface for the data channel and one for each of the voice channels it provides. The number of voice channels that are assigned will vary according to a channel-management unit's physical location in the network.

**Central calling.** The channel-management units handle data communications at the data link level as well as channel-access protocols. They interface to the central control unit, a Hewlett-Packard 1000, just as standard terminals communicate by way of dedicated telephone lines.

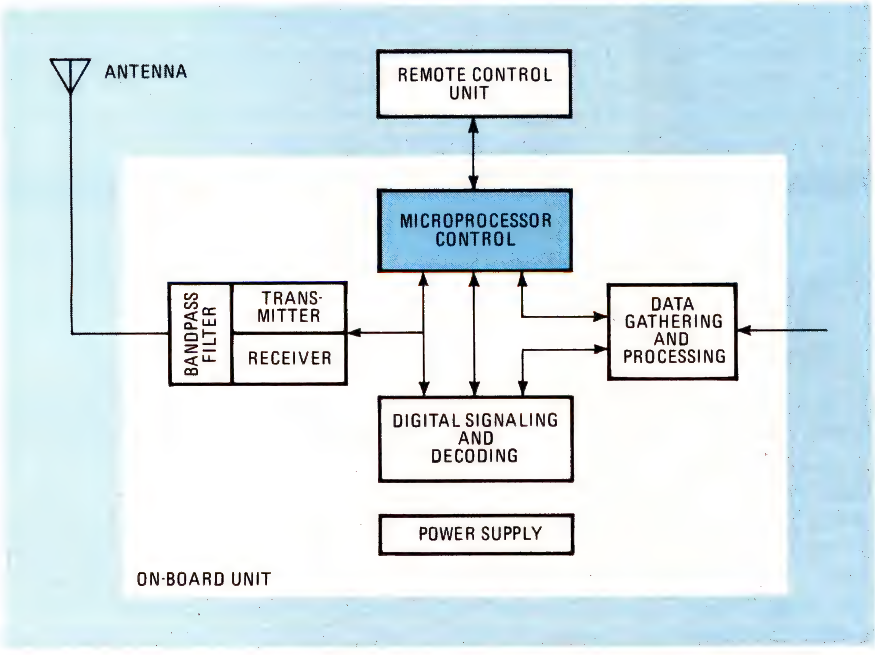
The central control processor controls actual polling sequences and interfaces with Turin's traffic-light control system. This processor is based on peripheral microprocessor control units, each of which controls a cluster of signal lights. In this way, it can adapt polling sequences dynamically to actual traffic situations as when, for example, a bus would be near a traffic light on a priority public transport route.

Decisions that tell a vehicle to speed up or slow down or that add more vehicles to a route are left to fleet control operators, who work from terminals connected to the central control unit. The role of the SIS system is to provide these operators with real-time data so that they can concentrate solely on operational decisions.

Vehicle polling and some traffic-light control will be automatic. Both polling and the collection of vehicle status data are transparent to the driver. Coded driving suggestions based on traffic conditions and route load will be displayed on his vehicle's terminal.

Just what information to provide and in what form to provide it will be one of the purposes of the pilot phase. In any case, the drivers and fleet-control operators will be able to communicate over the voice channels.

**–Robert Gallagher and Lois Bolton**



**Calling all cars.** Turin transportation's terminals subsystems consists of integrated digital receiving, transmitting, and data gathering and processing functions.

## TELECOMMUNICATIONS

# Politics delays NTT privatization

**Tokyo**—The Japanese effort to privatize its telecommunications business has been delayed for the time being by domestic political maneuvering, but new laws are expected to be enacted by the end of the year. The proposed laws [*ElectronicsWeek*, July 30, 1984, p. 16] are designed to create a more competitive private market by opening value-added network

# For reliable surface-mount packaging, rely on TI's copper clad Invar.

Now there's a far better way to solve thermal-expansion mismatch problems between multilayer boards and surface-mounted ceramic devices. Copper clad Invar foil from Texas Instruments. It's simply your easiest way to go.

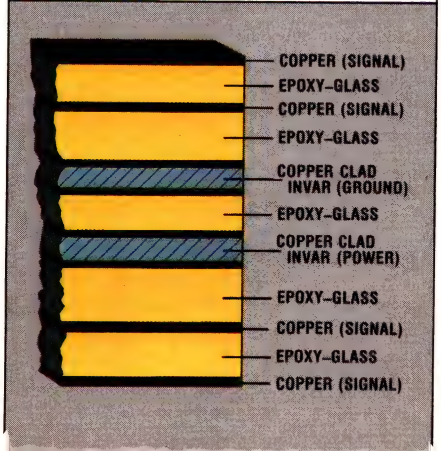
When substituted for copper as the ground and power planes in multilayer boards, TI's innovative copper clad Invar foil constrains thermal expansion. This eliminates solder-joint failures between leadless ceramic chip carriers and multilayer boards.

These same outstanding characteristics can help you produce higher quality boards and higher yields during fabrication. Fact is, TI's copper clad Invar foil handles so much like copper foil that you can easily integrate it into your conventional manufacturing process.

© 1984 TI 27-9227

What's more, TI's copper clad Invar foil is far more cost effective than other low-expansion alternatives.

**Simple to incorporate,** TI's copper clad Invar foil replaces copper as the ground and power planes in a typical multilayer board.



Others have already gained the advantages of surface-mount technology and are in full production today! So why wait? Put TI's copper clad Invar foil to work for you today.

**For more information** and a list of sources for treating and lamination, write Texas Instruments Incorporated, Dept. MMN873EC, P.O. Box 402250, Dallas, TX 75240. Or call 1-800-341-5202.

TEXAS INSTRUMENTS

Creating useful products
and services for you.

**Circle 43 on reader service card**

services to foreign participation as well as turning the Nippon Telegraph & Telephone Public Corp., which now monopolizes the common-carrier business, into a private entity.

The ruling conservative Liberal Democratic Party (LDP) of Prime Minister Yasuhiro Nakasone pushed hard to get the bills through the just-adjourned Japanese Diet session. Its concern was to not only to avoid creating any further trade friction with the U.S. but also allow ample time for legal preparations so that the laws could take effect with the start of the next fiscal year, April 1, 1985. The delaying tactics of the opposition Japan Socialist Party, which wants a right-to-strike clause included in the new NTT law, stymied those efforts.

Supporters of Nakasone, who faces a party election in November, gathered enough votes to get most other key LDP-backed bills through the current session, but did not want to risk another drawn-out debate, which could detract from their re-election efforts.

But the delay could have at least one positive side-effect. "This gives us more time to push for the inclusion of procedures under which U.S. laboratory test data or product certification for Japanese market use could be acceptable to the Japanese government," says Mark Foster, a lawyer who has been acting as special counsel to the U.S. Embassy on this and other issues. Trade officials from the U.S are in Tokyo for talks on Aug. 23 and 24, and telecommunications is certain to be among the issues raised.

If the Diet passes the bills as expected in December, it will put a great deal of pressure on the Ministry of Posts and Communications to get the detailed administrative ordinances prepared by the scheduled date of effect, April 1. "It will be difficult, but not impossible," said a ministry source. **–Michael Berger.**

## TELEVISION

# IC, made with top-down isolation, drives all TV-tube color cathodes

**Agrate, Italy**—A single integrated circuit that can drive all three color cathodes of a TV picture tube is the first fruit of a drive by Italy's largest components house, SGS-Ates Componenti Elettronici SpA, to boost the voltage-handling ability of linear ICs. The new TDA8150, with its maximum collector-emitter voltage of 250 V, is based on the firm's top-down isolation linear technology.

Aldo Romano, director of the company's bipolar division, asserts that modifications in the process will lead to voltages of 400 V in the near future and up to 700 V within a couple of years. That would suit the resulting circuits for use as internal system power supplies, because they would be able to withstand any spikes that could occur off the 120-V U.S. supply lines, and overvoltage problems that could occur off the 220-V lines that are standard in most of the rest of the world [*Electronics*, March 22, 1984, p. 73].

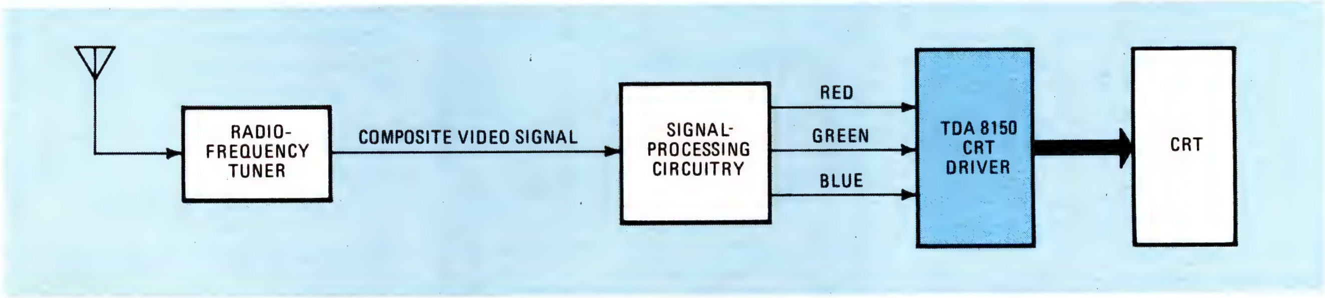
The TDA8150 consists of three output amplifiers—one each for the red, green, and blue drives of a cathode-ray tube. An additional circuit that generates the CRT's primary grid voltage works with an external condenser to eliminate all spots.

Each output stage is protected against arc discharges in the tube by an internal locking diode. The only additional necessary protection comes from an inexpensive circuit breaker to limit discharges to no more than 1,000 V.

**Simplified solution.** The TDA8150 replaces circuitry based on discrete transistors and is at least equal in performance, less expensive to fabricate, and significantly more reliable than standard solutions. First versions of the chip are based on the International Radio Consultative Committee's European norm, though SGS will soon offer a second model adapted to the NTSC standard.

The SGS top-down isolation technology relies on a two-step process to form collector isolation diffusion areas: the structures that prevent collectors from becoming elements of parasitic transistors. Standard single-step implantation requires a lengthy diffusion process and results in a large, bowl-shaped isolation area.

SGS's process carries out ion implantation both before and after the growth of the collector epitaxial layer. When the wafer is heated, these two areas diffuse and meet in the middle of the epi layer, forming a kind of hourglass-shaped isolation area. Because the diffusion time is shorter than the standard process, the isolation area is smaller and more of the epi layer is left free to handle voltage, thus accounting for the process' exceptional voltage tolerance. **–Robert T. Gallagher**



**All in one.** The TDA8150 is the first IC from SGS-Ates that makes use of the firm's 250-V top-down isolation technology. The IC consists of three output amplifiers, one each for the red, green, and blue drives of a cathode ray tube.

# SCIENCE/SCOPE

Artificial intelligence is the focus of a new advanced technology center at Hughes Aircraft Company. The facility brings research and development efforts under one roof. Scientists and engineers will work closely with universities throughout the country to develop software and equipment to build the so-called expert systems. Studies will center on knowledge representation, symbolic reasoning and inference, natural language processing, and knowledge acquisition and learning. Technology will be developed for image understanding for missile targeting and geological surveys from space, smart avionics to reduce pilot workload, self-controlled systems, simulation and training, fault diagnosis and maintenance, and manufacturing resource allocation and planning.

Improvements to a "super cooler" used with infrared sensors in space will extend the life and boost the efficiency of the device. The cooler, vital to defense applications and geological surveys, is a Vuilleumier cycle cryogenic refrigerator. It is designed to chill sensors near absolute zero to increase their sensitivity to thermal radiation. These coolers are ideal for use in space because the low internal forces required by this kind of cooling cycle cause little wear on bearings and seals. Hughes is working under a U.S. Air Force contract to extend the unattended operating life of the cooler beyond five years. The cooler will use less power, so smaller and fewer batteries are needed to power the device during eclipse periods—a savings of hundreds of pounds.

A new type of field-effect transistor has been used to produce ultra high-speed integrated circuits. The device, called the high electron mobility transistor, employs a heterostructure to transfer electron charge from a heavily doped aluminum gallium arsenide layer into an adjacent high-mobility ultrapure gallium arsenide layer. It promises improved performance at low temperatures. Hughes research scientists foresee such applications as digital frequency division and synthesis, high-speed signal multiplexing, memory and analog/digital conversion, and microwave low-noise amplification.

Development times for semicustom very large-scale integrated (VLSI) circuits have been cut from greater than one year to 20 weeks at an ultramodern computer-aided training and design center at the Hughes facility in Newport Beach, California. Utilizing advanced design automation software, a comprehensive library of predesigned logic functions (called Macros), and preprocessed wafers, the new facility is helping engineers design chips with 2,000 to 8,000 gates and with as many as 180 pins. New 3-micron dual-layer metal HCMOS processes are applied to both standard cell products and state-of-the-art gate arrays. Skilled design engineers and education specialists at the Newport Design Center provide training and technical support for IC designers throughout the company.

Hughes Research Laboratories needs scientists for a spectrum of long-term sophisticated programs. Major areas of investigation include: masked ion beam lithography, liquid-crystal materials and applications, submicron microelectronics, ion propulsion, computer architectures for image and signal processors, gallium arsenide device and integrated circuit technology (analog and digital), and new electronic materials. For immediate consideration, please send your resume to Professional Staffing, Hughes Research Laboratories, Dept. S3, 3011 Malibu Canyon Road, Malibu, CA 90265. Equal opportunity employer. U.S. citizenship required.

For more information write to: P.O. Box 11205, Marina del Rey, CA 90295

HUGHES
AIRCRAFT COMPANY

# While everyone quit at 5,

2K x 8 latched
2K x 8 latched timer, 2816A compatible
2K x 8 latched, full military temp.
2K x 8 latched timer, 2817A compatible
8K x 8 latched timer

© 1984 Seeq Technology, Inc.

It's not that we're gluttons for punishment.

It's just that at Seeq we take the E²ROM business seriously. So seriously that our engineers insist our parts fit your designs, not vice versa.

Maybe they got a little carried away.

At last count, they'd developed 12 different E²ROMs. Outperforming their counterparts at other companies two to one.

And they're responsible for more E² improvements than any other design team.

Most of these innovations quickly became industry standards. Like 16K densities. Single 5-volt power. And leadless-chip-carrier packaging.

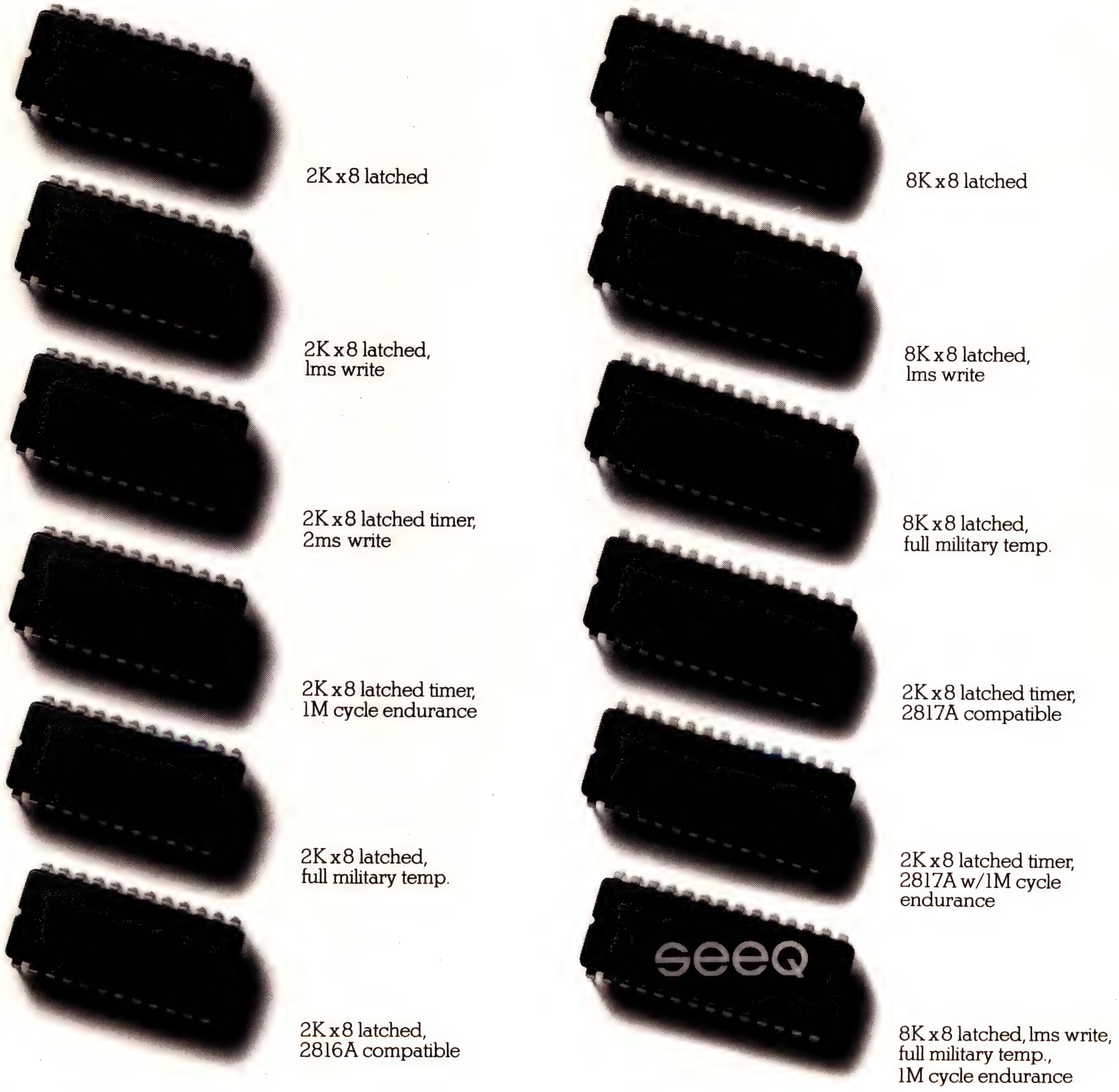
The rest are still unduplicated. Like our high-density, high-performance 64Ks. Exclusive DiTrace.™ Our industry-leading 1ms byte-write. And the world's first E² with million cycle endurance.

Plus there are plenty of ideas still on the drawing board. Because when it comes to designing new E²s, our engineers just hate to quit.

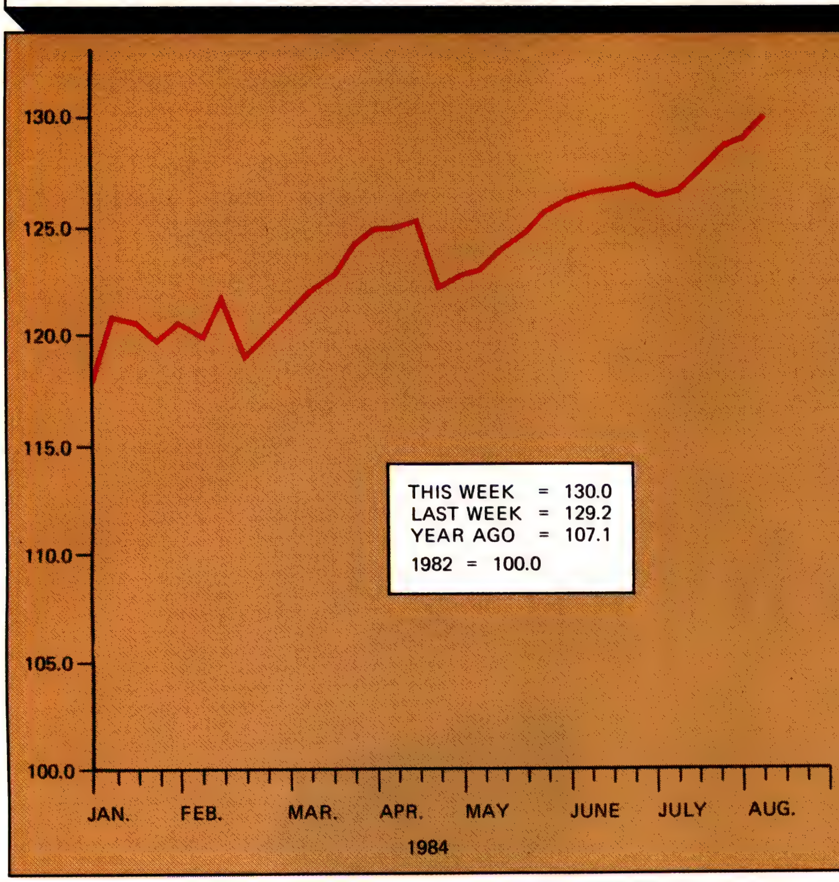
Especially while they're ahead.

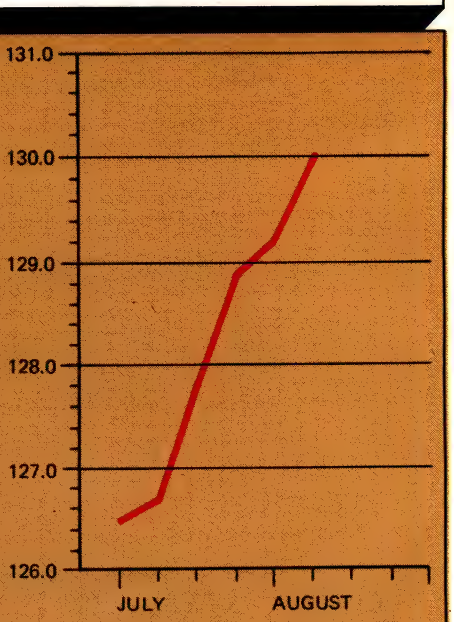
For information on the industry's most innovative E²ROMs, write or call Seeq Technology, 1849 Fortune Drive, San Jose, California 95131. Telephone (408) 942-1990. Or circle number 198 on the reader service card.

# we worked until 12.


2K x 8 latched
2K x 8 latched, 1ms write
2K x 8 latched timer, 2ms write
2K x 8 latched timer, 1M cycle endurance
2K x 8 latched, full military temp.
2K x 8 latched, 2816A compatible
8K x 8 latched
8K x 8 latched, 1ms write
8K x 8 latched, full military temp.
2K x 8 latched timer, 2817A compatible
2K x 8 latched timer, 2817A w/1M cycle endurance
seeq
8K x 8 latched, 1ms write, full military temp., 1M cycle endurance

# ElectronicsWeek Index





The *ElectronicsWeek* Index, a seasonally adjusted measure of the U.S. electronics industry's health, is a weighted average of various indicators. Different indicators will appear from week to week.

## U. S. INDUSTRIAL PRODUCTION INDEX

| **Production workers** (thousands) | June 1984 | May 1984 | June 1983 |
|---|---|---|---|
| Office and computing machines | 205.0 | 201.5 | 191.5 |
| Communications equipment | 281.9 | 279.1 | 261.1 |
| Radio and TV receiving equipment | 63.8 | 62.1 | 59.4 |
| Components | 424.1 | 414.2 | 341.8 |
| **Shipments** ($ billions) | June 1984 | May 1984 | June 1983 |
| Communications equipment | 4.682 | 4.439 | 4.179 |
| Radio and TV receiving equipment | 0.786 | 0.936 | 0.717 |
| Electronic and electrical instruments | 4.768 | 4.809 | 4.083 |
| Components | 3.931 | 3.687 | 2.909 |

***Increases in both*** industry shipments and employment helped fuel a rise in the *ElectronicsWeek* Index in the latest week. (Industry shipments and industry employment are two of the measurements used to compile the Index.)

Shipments of communications equipment, radio and television systems, instrumentation equipment, and components totaled $14.2 billion in June, up 2.1% over May's figure. Employment in these electronic industries rose 1.9% for the month.

The recent growth in these two business barometers, however, has not been evenly distributed. Producers of components have seen their sector outpace other areas of the electronics industry in both shipments of equipment and employment. In June, employment among manufacturers of electronic components was up 2.3%, while shipments jumped 6.6%. In contrast, employment in both the radio and TV equipment and the instruments sectors rose in June, although shipments of these systems fell during the month.

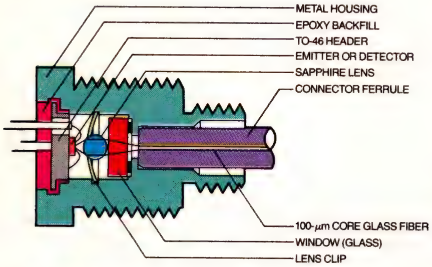
# Design in leadership with fiber optic components from HP.

*At Hewlett-Packard's Optical Communications Division, engineers use advanced research and development equipment to test state-of-the-art fiber optic components.*

**Depend on our commitment to fiber optic technology.** Today, fiber optics is a leading technology for data transmission because it's faster, more reliable, more secure and often less expensive than alternative technologies.

Hewlett-Packard's commitment to fiber optic technology began ten years ago. Since then, we've applied these years of experience in LED emitters, detectors, integrated circuits, optical fiber and packaging to make HP your best choice for fiber optic components.

Our wide range of fiber optic components gives you performance choices that are reliable, easy-to-use and cost-effective.

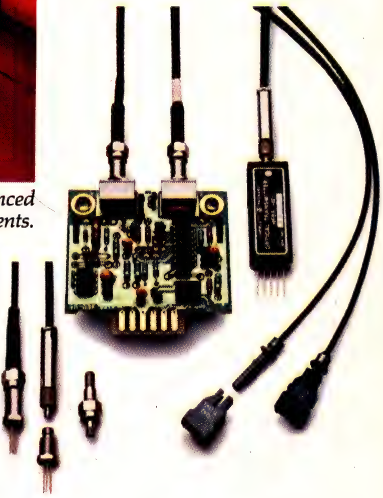


*This cross section of an HP fiber optic transmitter shows HP's advanced lensing scheme for optimal coupling of light into the fiber.*

**Choose from three families of products.**
There are currently three families of HP fiber optic products: Plastic Snap-In Components; Miniature Link Components; and High Performance Modules. The families are growing, too. New products will offer increasingly faster data rates and greater distances. Packaging developments and improved manufacturing techniques will keep costs coming down.

Start moving your data today with HP fiber optics and get the added assurance that your designs will keep you a leader tomorrow. HP's worldwide team of applications and sales engineers is ready to help you.

To learn more about HP fiber optics, circle the reader service number below. For pricing and delivery information, contact your local HP Authorized Components Distributor. In the U.S., call Hall-Mark, Hamilton/Avnet, Pioneer Standard, Schweber, or the Wyle Distribution Group. In Canada, call Hamilton/Avnet or Zentronics, Ltd.

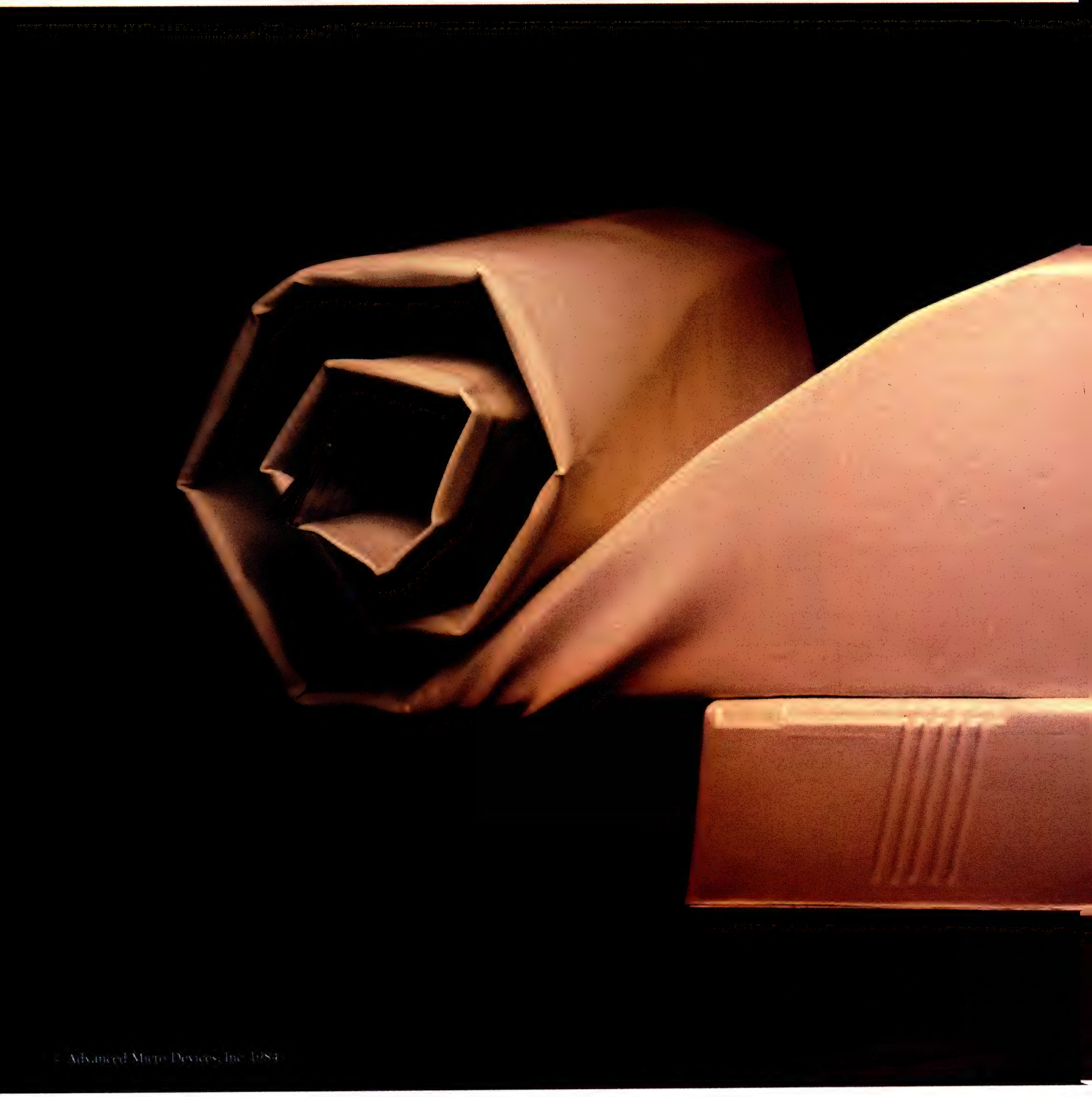


**HP: The right choices for moving data today and tomorrow.**

HEWLETT PACKARD

Circle 49 on reader service card

**SQUEEZE**



**Advanced Micro Devices** • **Bruxelles** (02) 771 99 93 • **Hannover** area (05143) 53 62 • **Hong Kong** (852) 3 695377
**London** area (04862) 22121 • **Manchester** area (0925) 828008 • **Milano** (02) 339 0541 • **München** (089) 40 19 76
**Paris** (01) 687.36.66 • **Stockholm** (08) 98 12 35 • **Stuttgart** (0711) 62 33 77 • **Tokyo** (03) 329-2751

]

# MORE OUT OF THE TUBE.

AMD's CRT controller family wrings every last drop of performance out of your video screen.

You get a dazzling, attractive display your customers will find irresistible.

### The Am8052. You'll wonder where the flicker went.

Thanks to on-board DMA and triple row buffers, you get vertical and horizontal split screens, with smooth-scrolling windows. All flicker-free.

You even get double-height and double-width characters, superscripts and subscripts.

### The Am8152A/53A. Make your display look its sparkling best.

You get cleaner, crispier characters with the 100MHz video system controller. And proportional spacing down to two pixels.

No other VLSI chip set gives you as much.

And to top it off, the chips even take over many of the functions of the CPU. Like linked list manipulation for easier editing. Your CPU has better things to do.

### We'll put you as far ahead of the competition as we are.

Controllers. Bipolar and MOS microprocessors. Communication circuits. Signal processors. Nobody makes as many peripherals for as many microprocessors as AMD.

And every single chip meets or exceeds the International Standard of Quality.

The International Standard of Quality guarantees a 0.1% AQL on all electrical parameters, AC and DC, over the entire operating range.

INT-STD-1000

If you want the most out of your tube, put the squeeze on AMD. We'll show you several ways to put the sparkle in your customer's smile.

**Advanced Micro Devices**

For more information, contact the sales agent nearest you or write the words "CRT CONTROLLER" on your letterhead and mail to Advanced Micro Devices,
Mail Operations, P.O. Box 4, Westbury-On-Trym, Bristol BS9 3DS, United Kingdom.

# Plan your LinCMOS

High speed, exceptionally low power consumption, and multipurpose analog and/or digital inputs—new LinCMOS™ microprocessor-controlled data-acquisition systems from Texas Instruments deliver all! You can forget about traditional performance "tradeoffs."

You only have to remember TI. And two new LinCMOS families: The 28-pin TLC532A family with parallel output, and the 20-pin TLC540 family with serial output for interface to a variety of popular microprocessors.

## One-chip data-acquisition system

Both families provide an entire data-acquisition system, from analog multiplexer to digital data bus, on one chip. You treat the IC as a simple plug-in component, replacing a board of parts.

Eliminating external components also reduces total system costs. And the chip itself is less costly than many metal-gate CMOS ICs having only an A/D converter function.

One potential application for the new LinCMOS peripherals is environmental control. An array of these A/D peripherals could sense room temperatures throughout a building and feed them to a microprocessor that instructs the heating/cooling system to direct air where it is needed.

Result: Energy bills could be slashed by a simpler, more cost-effective system.

---

◀ **Moving energy costs down** by moving air around—that's how TI's new LinCMOS A/D peripherals could work in a large building. These ICs could take multiple readings of each room's temperature for a microprocessor that quickly determines where warmer or cooler air is needed.

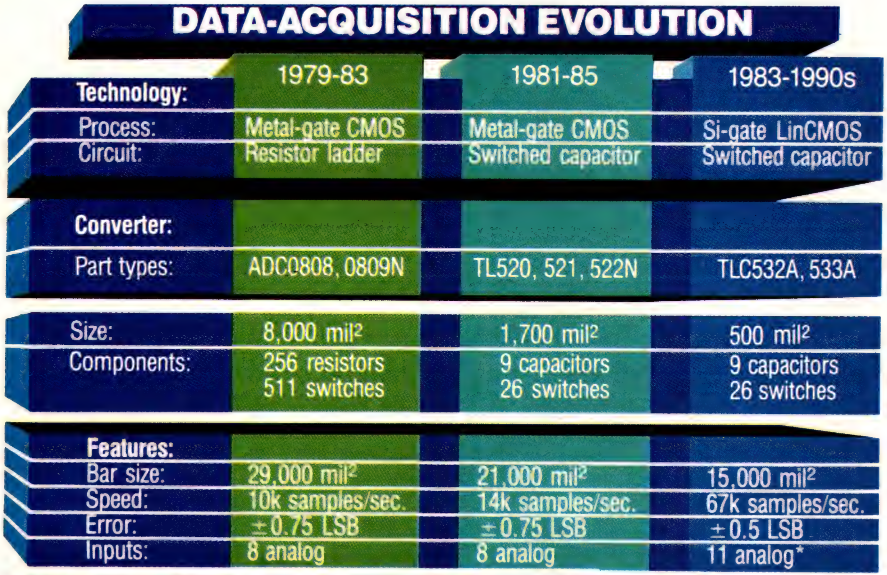
™Trademark of Texas Instruments Incorporated

Photo taken at Plaza of the Americas, Dallas, Texas.

27-5077 A

©1984 TI

# control system with TI's new microprocessor-controlled A/D ICs.



DATA-ACQUISITION EVOLUTION

| | 1979-83 | 1981-85 | 1983-1990s |
|---|---|---|---|
| **Technology:** | | | |
| Process: | Metal-gate CMOS | Metal-gate CMOS | Si-gate LinCMOS |
| Circuit: | Resistor ladder | Switched capacitor | Switched capacitor |
| **Converter:** | | | |
| Part types: | ADC0808, 0809N | TL520, 521, 522N | TLC532A, 533A |
| Size: | 8,000 mil² | 1,700 mil² | 500 mil² |
| Components: | 256 resistors<br>511 switches | 9 capacitors<br>26 switches | 9 capacitors<br>26 switches |
| **Features:** | | | |
| Bar size: | 29,000 mil² | 21,000 mil² | 15,000 mil² |
| Speed: | 10k samples/sec. | 14k samples/sec. | 67k samples/sec. |
| Error: | ±0.75 LSB | ±0.75 LSB | ±0.5 LSB |
| Inputs: | 8 analog | 8 analog | 11 analog* |

*Includes six multipurpose inputs.

**Major speed improvements,** more inputs, smaller size—the evolution to LinCMOS products from metal-gate technology reflects big performance boosts and operational advantages, creating a bright linear future.

## Up to 71,000 samples per second

Dramatic speeds are available—as fast as 71,000 samples per second. With power requirements as low as 6.0 mW.

This allows noise canceling and precise control of blower motors or heating elements. While virtually eliminating bulky power supplies.

## Exceptional stability over a wide temperature range

Both the TLC532A family and the TLC540 family offer excellent temperature-range stability—total output error is within ±0.5 least significant bit (LSB) over a wide temperature range—from −40° to 85°C.

Military versions, also available, are stable within ±0.5 LSB over a −55° to 125°C temperature range.

## Handle up to 11 inputs

Each LinCMOS A/D peripheral family allows a processor to monitor up to 11 analog signals. Six signals can be digital, if preferred, allowing keyboard or switch-position sensing.

These devices feature a built-in sample-and-hold circuit (software-controlled on the TLC540) that holds a "snapshot" of the input signals to reduce the effects of noise and random spikes.

## Immediate availability

All of these LinCMOS A/D peripherals are TTL, MOS, and CMOS compatible. And all are available now. With performance that will change the way you look at linear.

Environmental control is only one possibility. These LinCMOS peripherals offer many opportunities in test equipment, automotive instrumentation, industrial controls, robotics, toys, home computers, signal processing, and other applications.

**For more information** on TI's A/D converters, op amps, and the LinCMOS process that creates them, call your authorized TI distributor or nearest TI sales office. Or write Texas Instruments Incorporated, Dept. SLA043EC, P.O. Box 809066, Dallas, Texas 75380-9066.

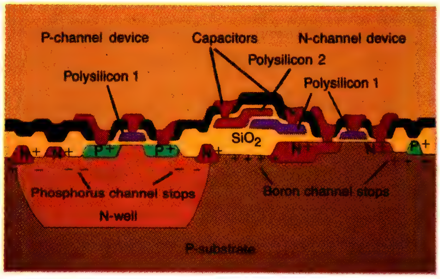
## TI is first with silicon-gate CMOS for linear.

The key to a successful combination of CMOS and bipolar capabilities: Phosphorus doping of the silicon gates that effectively halts and binds sodium ions—the main cause of threshold voltage shifts in MOS-based technologies.

For enhanced carrier mobility, NMOS transistors are placed in a p-type substrate and the PMOS transistors in an n-well. This increases carrier mobility of the NMOS transistors to about 3.7 times that of the PMOS transistors, enhancing speed.

The LinCMOS process also provides a gate-to-drain capacitance about one-seventh that of metal-gate CMOS. This performance stems from gate formation, which is accomplished in the same step that forms the transistor source and drain. The source, gate, and drain are all self-aligned, boosting speed and enhancing the bandwidth even further.

And the final result: A built-in speed advantage that greatly enhances AC performance and makes possible the 20X speed improvement of the TLC532A over its pin-compatible metal-gate TL532 predecessor.



TEXAS INSTRUMENTS

Creating useful products
and services for you.

Circle 53 on reader service card

# GEN. ABE'S APPROACH TO SPACE DEFENSE

The man deserves a medal," says one industry executive of Lt. Gen. James A. Abrahamson, whose title since April has been director of the Strategic Defense Initiative Organization, the new military effort nicknamed "the Star-Wars Initiative" when President Reagan advanced the proposal in March 1983. He deserves a medal not for the challenge of his new assignment, the executive explains, but "just for taking the job in the first place.."

General Abe, as his colleagues refer to him, a 51-year-old engineer with a disarming manner, clearly doesn't see his SDIO job that way. An aeronautical engineer and Massachusetts Institute of Technology grad, he has taken on tough jobs before, winning his first management medal as director of the successful project to build the Air Force F-16 combat fighter, which was delivered on time and as close to projected cost as any modern weapon. Before taking on his job at SDIO—where he reports directly to the Secretary of Defense—Abrahamson was on loan to the National Aeronautics and Space Administration, where he oversaw development of the Space Shuttle.

As SDIO chief, the general is moving quickly. The first request for proposals "to define the overall planning and architecture needed for a strategic defense system" was announced in mid-July, with documents available to prospective contractors by the end of August. How many study contracts does Abrahamson plan to award? "On the order of 10 to 12," he said after a three-day session for industry on the policy and technology aspects of SDI. The closed meetings dealt with directed-energy weapons, including lasers and kinetic energy weapons; optics; and surveillance, acquisition, tracking, and kill assessments.

As for money, Abrahamson says he expects to get Congress to appropriate "a substantial chunk" of the $1.77 billion sought in the fiscal 1985 Reagan budget. Congressional budget action is not yet complete—and may not be before the election—but Abrahamson's chunk looks like it will be around $1.37 billion, more than three quarters of the requested funds.

With concern growing about federal budget deficits running in the $200-billion range, Abrahamson's SDIO would seem to be a prime political target, leading to considerable misery for him. It's open to question whether Abrahamson deserves credit for the fact that the Reagan SDI program has not yet become a hot political topic in an election year.

Certainly, some of General Abe's intentions are appealing: his determination to bring down the costs of military subsystems like telemetry and data processing sounds good, but domestic industry and its foreign competition have been bringing down those costs without military support. More appealing is his determination to hold his organization's staff to no more than 80 people, with emphasis on centralized planning but decentralized execution by contractors, with minimum reporting.

What worries congressional budget-watchers about General Abe, though, is his philosophy on accelerated procurement, an idea he says the SDI managers are experimenting with. In Abrahamson's view, "speed is a matter of efficiency" in developing new programs with new technologies.

"The only way to do it cheaper is to do it faster," he contends. The approach is troublesome for some military and congressional money managers, who have seen too many weapons programs proceed with concurrent development and production with both the taxpayer and the military user losers on the basis of performance.

–**Ray Connolly**

IEEE-488

# A clear display of superior performance.

**Introducing the Fluke 8840A Digital Multimeter**

One look tells you it's different.

From its exclusive vacuum fluorescent display that's easier to read. To a simplified new design that's easy to use.

But look again.

Because inside are more features for less money than any other 5½-digit DMM in its class.

Including superior dc accuracy that the competition can't touch— 50 ppm for 1 year; 20 ppm for 24 hours.

There's closed-case calibration. And two self-test levels are built in to ensure accuracy and ease of service.

The 8840A comes standard with dc volts, 2- and 4-wire ohms, current and sensed front/rear input switching.

It has fast autoranging and multiple reading rates. Plus you can add two inexpensive options: IEEE-488 and true rms ac.

You can't see them, but the 8840A is filled with new Fluke manufactured ICs and devices for even greater accuracy and reliability.

But there is one thing you **can** see that automatically makes the new Fluke 8840A today's best buy in a bench or rack-mounted DMM.

Its price. $695.*

To see the new 8840A for yourself, contact your local Fluke Sales Representative, or contact us at the addresses below.

FROM THE WORLD LEADER IN DIGITAL MULTIMETERS.

**Fluke 8840A**

Volts, Ohms, Amps
0.002% basic dc accuracy
0.16% basic ac accuracy
2½, 20, or 100 readings/sec
$150* true rms ac option
$150* IEEE-488 interface option

IN THE U.S. AND NON-EUROPEAN COUNTRIES:
**John Fluke Mfg. Co., Inc.**
P.O. C9090, M/S 250C
Everett, WA 98206
(206) 356-5400, Tlx: 152662

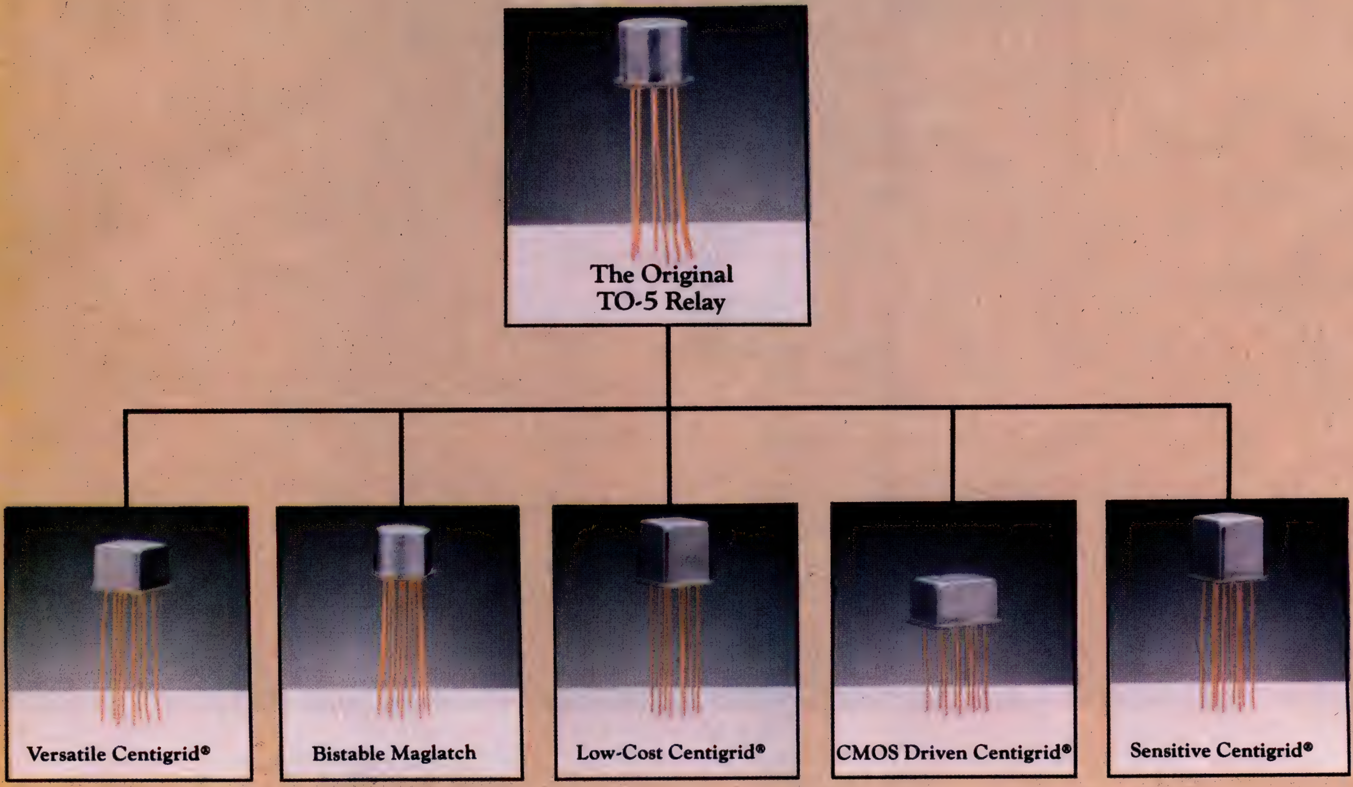
IN EUROPE:
**Fluke (Holland) B.V.**
P.O. Box 5053, 5004 EB
Tilburg, The Netherlands
(013) 673973, Tlx: 52237

FLUKE®

*U.S. List Price

Copyright ©1984, John Fluke Mfg. Co., Inc., Ad No. 2801-8840 For technical data circle number 54

# From the industry's first choice come the industry's first choices.



We designed the original TO-5 relay over 20 years ago. But that was just the beginning. Since those first days, we nudged it into fathering a family of adaptations and extensions along the way.

In the process we also pioneered many innovative techniques for production, for manufacturing, and for quality control to ensure a reliability level so consistently high it would be taken for granted.

Of course, for us it never was.

Soon, TO-5 relays were available in latching versions, in single, double and 4-pole styles, and in hybrid versions with internal diode and transistor drive. All with excellent RF switching characteristics.

Today, there's a version for just about any application—general purpose and sensitive, commercial, and military (qualified to "L," "M" and "P" levels of MIL-R-39016).

Our family boasts the Centigrid,® possibly the most advanced hermetically sealed armature relay available today. The Maglatch, a relay with memory and low power requirements. And lots of brothers and sisters to handle applications like high temperature, high shock, and high vibration designs for critical, hi-rel applications. We even have versions that can be driven directly from CMOS and TTL (qualified to "L" and "M" levels of MIL-R-28776).

If you'd like complete technical information on our TO-5 relay and all its offspring, or some applications help, or just a little history, drop a note or give us a call.

Like proud parents, we love to talk about the family.

**TELEDYNE RELAYS**
**Innovations In Switching Technology**

Circle 56 on reader service card

12525 Daphne Ave., Hawthorne, California 90250 ◆ (213) 777-0077
U.K. Sales Office: Heathrow House, Bath Rd., Cranford, Hounslow, Middlesex, England TW5 9QQ ◆ 01-897-2501
European Hqtrs.: Abraham Lincoln Strasse, 38-42 ◆ 6200 Wiesbaden, W. Germany 06121-7680
Japan Sales Office: Nihon, Seimei Akasaka Building ◆ 8-1-19 Akasaka, Minato-Ku, Tokyo, 107 Japan (03) 403-8140
France Sales Office: 85-87 Rue Anatole-France ◆ 92300 Levallois-Perret, France ◆ 758-71-60

# EIA'S McDONNELL REVAMPS TELECOMMUNICATIONS GROUP

**Washington, D.C.**

At a time when the U.S. telecommunications industry is in the throes of a major structural and technological upheaval, it strikes John J. McDonnell Jr. as odd that the Electronic Industries Association's telecommunications group hasn't appreciably changed in 15 years. Thus, four months after assuming the post of telecom group vice president, he reports that he has won his members' support for a reorganization plan designed to give them "much more political clout within EIA and on Capitol Hill."

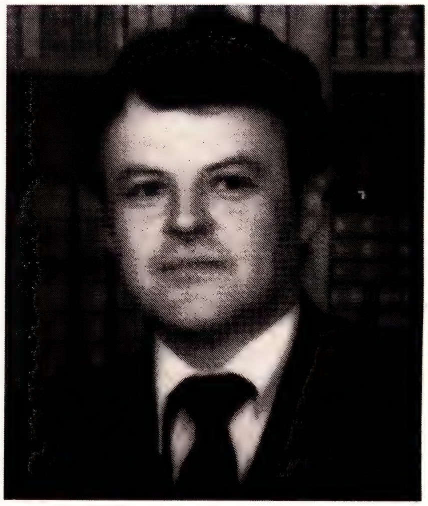
This September, the telecom group will formally become the Information and Telecommunications Technologies Group, divided into four equipment sectors: customer-premises, network, mobile-radio, and fiber-optic equipment. Previously, there was no divisional structure, notes McDonnell. The members were all lumped in the telephone equipment category. "They could never agree upon an agenda, and, frankly, the entire process was becoming unwieldy," he says.

Furthermore, the old structure did not allow for recruiting new members. "When I testify on the Hill, I feel somewhat shamed that I am only speaking for 70 companies," he comments. Hence, under each of the new sectors, McDonnell has created separate technology sections with an eye to luring recent start-ups. The network sector, for example, includes local-net and packet-data-switching sections.

Restructuring the EIA's telecommunications shop was necessary not only to increase membership, but also to prepare for future industry activities, the 46-year-old EE explains. "Six years ago I joined Tymnet Inc. to be a pioneer in the development of a new technology," he recalls. At the Vienna, Va., company, McDonnell rose from manager of Eastern regional sales to vice president of the firm's worldwide operations.

In the EIA, McDonnell says he again saw the chance to be there "when the next technology wave hits the beach." One of the first tasks of the local net section will be to get to work on standards and take the lead from the Institute of Electrical and Electronics Engineers, which has already endorsed both the token-ring architecture and Ethernet. He also plans to push the network division to pick one of two standard interfaces for computers and private branch exchanges: DMI, proposed by AT&T Co., or CPI, developed by a team from Digital Equipment Corp. and Northern Telecom Inc.

What really excites McDonnell about these standards is that they are all leading to the same place: integrated-service digital networks. "As with packet-switched networks, the U.S. is going to be blessed with multiple ISDNs," he predicts. Making them compatible is one mission he awaits eagerly. –**Karen Berney**


**Challenge.** John J. McDonnell Jr. sees a mission in developing telecom compatibility.

## CORWIN OF AT&T REACHES OUT AND KEEPS OLYMPICS IN TOUCH

**Los Angeles**

Even with the meticulous planning that launched AT&T Technologies' bellwether Electronic Messaging System (EMS), which tied together the Games of the XXIII Olympiad at Los Angeles this summer, there were still some big surprises in store for the telecommunications sponsor. "The traffic was far and away more intense—maybe four times heavier—than we planned for," explains Walter Corwin. As supervisor of EMS Development for AT&T's Bell Laboratories, the young-looking engineer, not yet 40, shepherded the one-of-a-kind system from its inception in January 1982.

On some days during the games, EMS handled nearly 200,000 transactions. Accredited users sending messages throughout the system accounted for two thirds of the total; the remainder were requests for results and information concerning the Games.

The estimated total transactions for the entire 2-week Olympiad period were near three million, AT&T officials say. This does not include the voice traffic, which logged an additional 300,000 calls a day. As the message totals show, Corwin's system became a mainstay for officials, journalists, and athletes throughout the 17 games sites, which sprawled over a 200-mile area [*Electronics-Week*, Aug. 6, 1984, p. 17].

Corwin gives credit for supporting these demands to the 14 3B20S AT&T minicomputers linked in a distributed interprocessing arrangement with the Unix System V operating system. "It's the first networking of CPUs on an interprocessing basis we know of," he says. The data

**Hello.** Walter Corwin sees the AT&T EMS message system used at the Olympics as a test for general consumer use.

base that Corwin's AT&T team had ready for EMS was adequate for even the higher level of traffic, with each of the computers provided with 12 megabytes of random-access memory and three additional 300-Mb disk drives.

The Olympiad experience was valuable to the Bell Labs engineer, who sees the Games as an ideal real-world market test for terminals and other equipment that must be made readily accessible to those who aren't computer literate. In fact, AT&T researchers were right there, hard at work digging out user reactions. This data is now being assembled and analyzed as the basis for the communication giant's next moves with the EMS.

Corwin, who had recently performed a similar task for Disney World's Epcot Center, in Orlando, Fla., has developed a specialty in building the EMS equipment. The 1966 graduate of Brooklyn Polytechnic Institute obviously enjoys the challenge of tailoring telecommunications for the novice public user, something, he claims, that Bell has always done well. As do most of the company's officials, he believes that parts of the Olympics EMS will soon be commercialized.

Despite being in the middle of Olympic action during the games, Corwin found little time to watch events. "I saw only one thing, a soccer match between Italy and Egypt, and that was because tickets happened to be available at the right time." **–Larry Waller**

## Orth uses novel four-pronged approach to keep ITT on a profit-making course

**Pforzheim, West Germany**

At a time when many European entertainment electronics producers are plagued by nearly saturated markets, stiff Far Eastern competition, and tight-fisted consumers, it is refreshing to hear from a company that's not posting losses. Such is the case with the ITT Corp.'s Consumer Electronics Group, the European audio and video electronics arm.

For the past three years, the group has operated in the black. Sales during the first half of this year are far above the average for West Germany's entertainment electronics sector as a whole. The man behind it all is Ludwig Orth, vice president of ITT Europe and head of the group, which employs 5,000 people. He has a four-pronged company strategy: getting innovative products to market fast, stressing automated production, emphasizing exports of subassemblies, and granting retailers enticing inducements.

With it, the 51-year-old executive is confident he can keep the group on a steady course, maintaining the sales increase through the end of 1984 and beyond. "Even under worst-case market conditions, we should succeed in scoring an above-average gain," he says.

Orth, who holds a Ph.D. in industrial economics from the University of Frankfurt, started his sales career at Siemens AG in 1953. He has held top management positions at AEG-Telefunken and headed that company's office equipment subsidiary, Olympia Werke AG. He joined ITT Europe in 1980 and two years later rose to his present position.

The advantage of being early with advanced products is exemplified by ITT's being the world's first company to come out with digital color television sets last year [*Electronics-Week,* Aug. 13, 1984, p. 49]. It has been a profitable pioneering. Since the beginning of this year, ITT has produced more than 40,000 digital sets. "Next year's target is 150,000 units," Orth says.

Helping to keep costs down and thus sharpen the group's competitive edge are what ITT believes to be Europe's most highly automated production facilities, in Bochum. The plant employs "automation equipment not to be found in any other color TV plant around the world," Orth maintains.

Like many other German TV set makers, ITT is a heavy exporter. But Orth has found a way to expand markets by pushing exports of components and subassemblies for assembly in "countries to where the export of finished sets is not possible because of monetary or import regulations," he says.

The final strategy in building sales is dealer incentives. "Since innovative products can be marketed only in close cooperation with competent retailers, the distribution policy must be continuously updated," he says.

He is trying a new method that breaks with convention by no longer rewarding retailers solely on the basis of their sales volume. To do so, Orth believes, might result in overly aggressive pricing tactics. Instead, ITT dealers are also rewarded, with favorable wholesale buying conditions, based on how well they present ITT wares, provide service, and give customers advice. **–John Gosch**

**Inventive.** Ludwig Orth has kept profits high for ITT's Consumer Electronics Group.

# STC'S ACQUISITION OF ICL TO MELD TELECOM, COMPUTERS

**London**

If big is beautiful, then the combination of Standard Telephones & Cables plc and International Computers Limited plc is indeed very attractive. The proposed merger between STC, the British telecommunications equipment maker, and ICL, the UK's only significant mainframe computer maker, would create an entity with a joint turnover of around $2.6 billion. This would make it the largest exclusively electronics group in the UK and the third largest in Europe, though a distant third behind West Germany's Siemens AG and the Dutch Philips, industry watchers note.

The combined group would create a world-class organization well positioned to exploit the converging worlds of computers and computing, believes Sir Kenneth Corfield, the STC chairman and the mastermind behind the bid. Its products would range from personal computers to large mainframes; from memory chips and custom very large-scale integrated circuits to digital private automated branch exchanges; and from radio communications gear to fiber-optic links.

**No guarantee.** Size, though important, is no guarantee of success, as both Philips and Siemens, struggling with a rising wave of U.S. and Japanese imports, have found out. "What matters is not so much the size of a firm but its expertise in specific fields. That's the deciding factor in most cooperative deals," says a German industry observer. "Smaller firms often succeed in the market faster than do large companies."

In launching his bid for Britain's flagship computer maker, Corfield was in no doubt as to the logic of the combine and the skills that each would bring to it. Users, he says, now want to hook together data processing systems so they can communicate over data networks, through cable, local networks, and digital exchanges. So success will increasingly go to those manufacturers that can provide telecommunications and data processing skills from a single source.

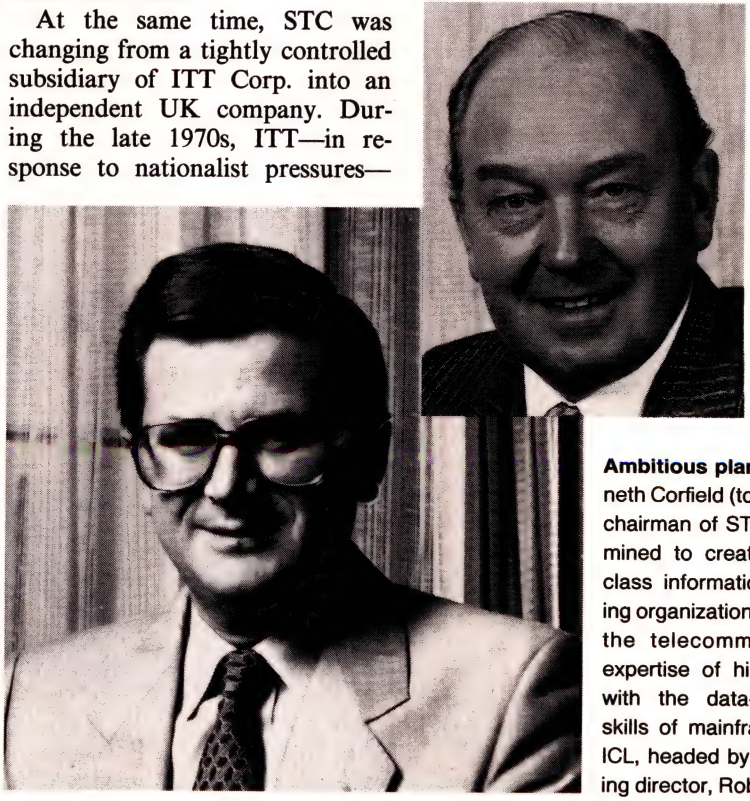
**Already committed.** Ironically, ICL, under the hard-driving direction of chief executive Rob Wilmot, was probably the first vendor to commit its entire product strategy to this philosophy. He was brought in three years ago from Texas Instruments' UK subsidiary, where he was managing director, to rescue the shipwrecked computer maker.

Wilmot slashed away at overhead and set about developing a networked product strategy. He also began to put into place a series of alliances with such firms as Fujitsu Ltd., Tokyo, concerning semiconductors and IBM-compatible mainframes, Mitel Corp., Kanata, Ont., Canada, on digital PBXs, and most recently with AT&T Co. on value-added networks.

At the same time, STC was changing from a tightly controlled subsidiary of ITT Corp. into an independent UK company. During the late 1970s, ITT—in response to nationalist pressures—sold off chunks of its European subsidiaries, and by 1981 STC had gained its independence. There are still close ties; ITT owns 35% of STC, has three executives on its board, and has a technology-exchange agreement that gives STC access to ITT products.

"They have demonstrated the ability to get out from underneath the ITT shell," says William Dixon of Scott Goff Layton and Co., a London brokerage house. "They have a good relationship with British Telecom, even though they lost the System X public digital exchange business; they do extremely well in undersea cables; and they have shown flair in getting into new markets."

On gaining independence from ITT, Corfield immediately began a thorough overhaul of STC's management structure and embarked on an acquisition program.



**Ambitious plans.** Sir Kenneth Corfield (top right), the chairman of STC, is determined to create a world-class information-processing organization by melding the telecommunications expertise of his company with the data-processing skills of mainframe maker ICL, headed by its managing director, Rob Wilmot.

The ICL takeover would roughly double STC's business and give it access to ICL's broad customer base and sales force. The two groups would also find synergy in advanced software and in VLSI design. Together they would have the critical mass to bolster STC's Harlow, Essex, research center, at one time the largest lab in the research operation of ITT Corp. "I have never seen anything dovetail so well in my life," says Corfield.

**One-sided need.** Analysts such as Michael Bean of Henderson-Crosthwaite and Neil Barton of the Manchester brokerage firm, Henry Cooke Lumsden, agree on the logic of convergence but question whether STC offers the best match. "STC needs ICL, but does ICL need STC?" asks Bean.

Barton, a one-time financial controller with ICL's mainframe division, says the deal is good for STC financially and technically. ICL has a clean balance sheet, a revamped product line in the works, and can offer a broadly based sales operation, whereas STC's is matched to serve a single monoploy user, British Telecom.

Dixon, who is in favor of the deal, stresses STC's excellent management reputation and the financial security that would result from the merger. STC's contract with British Telecom, to supply TXE4 semi-electronic exchanges until the System X digital exchange can be phased in, will provide the funds for new business developments. He also stresses the different skills the two bring to the marriage.

From ICL's angle, the merger may jeopardize its line-up of licensing and technology agreements. The most contentious is Corfield's plan to replace the digital switch made by Mitel with a product derived from ITT's System 12 family of digital exchanges. Still, as one analyst observes, the Mitel switch is an actual product, whereas the System 12 switch is still very much in the discussion stages.

But there is one flaw in the match that all are agreed on. Neither company has a strong marketing presence in the U.S. If Corfield pulls off this merger, that is one problem he will have to address quickly, observers agree. –**Kevin Smith**

## New marketing challenges confront IBM as it faces a changing low-end market

**Armonk, N.Y.**

With microcomputers becoming increasingly commodity-like, IBM Corp. faces new marketing challenges as it continues to lead the vendor pack. The firm, which has emerged as the prime seller of microcomputers, will have no choice but to cut marketing expenses and depend more on independent dealers to sell certain products, industry analysts argue. These observers, who say IBM has caused another problem for itself by overproducing PCs, also expect many changes in IBM's distribution methods and rapid growth in its National Distribution Division.

IBM is expected to sell over 1.7 million Personal Computers next year, according to Peter Wright of the Gartner Group, Stamford, Conn. Wright says 70% of them will be sold through dealers, with IBM's National Accounts, National Marketing, and National Distribution divisions each marketing about 10%.

Before IBM launched the PC, very few products reached customers untouched by salesmen. "But now [IBM] can't afford to spend 20% of the PC's price on marketing," says one industry analyst, who requested anonymity.

IBM believes the Montvale, N.J., NDD, which deals in small and intermediate systems, will achieve the fastest growth rate in the corporation this year. NDD is now responsible for about 10% of IBM's revenue; this will jump to about 15% to 20% by 1989, claims the analyst.

IBM plans to have about 4,000 employees working in NDD by 1985, most of whom will be transferred from NMD, says Gerard Guyod, president of MV Publishing Inc., Newport Beach, Calif. Spokesman Thomas Mattia confirms that IBM is beefing up NDD's staff, but would not give the number of employees.

Formed last November, NDD comprises the Supplies Division, the Distribution Channels unit, and the Retail Marketing unit. "IBM tried many alternatives to find the right means of marketing [low-end products]. They admit they didn't know much about alternate distribution because they hadn't done it," says the unnamed analyst.

Michael Geran, an analyst with E.F. Hutton & Co., expects NDD to expand faster than IBM's National Accounts Division over the next five years. "Over the long term, IBM will have less trouble getting into low-end products profitably," he says.

The Distribution Channels unit, which markets to value-added retailers and dealers, was originally set up as an Independent Business unit. "IBM is a centrally run company that needs great coordination. It realized a separate unit wouldn't make sense," says one source. Mattia says the unit was started simply to investigate new business opportunities. IBM now has over 14,000 authorized PC dealers and more than 1,100 value-added retailers. "I think you'll see a broadening of distribution channels—not necessarily under the IBM name," he says, adding that IBM is acting to standardize systems, making purchasing decisions and operation easier for consumers. –**Steve Haggerty**

**New look.** The success of IBM Corp.'s line of Personal Computers has caused the firm to reevaluate the way the system is marketed and distributed.

# The World-Class 8 or 6-channel recorder.

## Featuring a full range of computer interfaces.

World-Class! That describes the new ZF-8000 by Astro-Med, the graphic recorder pace setter since 1971.

**Computer interfaces.** Astro-Bus, standard on all ZF-8000 models, provides computer access to the recorder via IEEE-488 or RS-232 interfaces. Accepts IRIG H, A, or B codes.

**Z-fold charts.** The most convenient chart presentation technique ever devised.

**Point writing.** Clear, crisp traces (black or blue) at all writing speeds. Instant-warmup patented stylus.

**Position feedback galvos.** Nearly 100% accuracy, with response from DC to 150 Hz.

**Microprocessor controlled chart speed selection.** More than 743 speeds to choose from.

**Microprocessor-controlled alphanumeric printing.** Date, time and chart speed by simple keyboard selection. And, optional printing of external events such as pressure, rate, signal source origin, etc.

**Plug-in signal conditioners.** Pick the plug-in for your application, whether aerospace, medical, scientific, or—you name it.

The Astro-Med ZF-8000 is the World-Class recorder in every way. Write, phone, or Telex for more information today!

☐ Send me a free 12-page "demo" brochure with details about the ZF-8000 recorder.
☐ My recorder needs are__________
☐ Phone me to arrange a ZF-8000 demo.

Name__________ Title__________
Company__________
Address__________ City__________
State__________ Zip__________ Phone__________

**Astro-Med, Inc.**
Atlan-Tol Industrial Park, West Warwick, Rhode Island 02893
Telephone (401) 828-4000 TWX No. 710-382-6409
Circle 61 on reader service card

EM 8/20/84

---

# SLIM TYPE & DIRECT DRIVE

## Floppy Disk Drives From Japan

APPLE II, IIe & IIc Compatible
5¼ inch Mini Floppy Disk Drives

## NF-555/555C

- Boogaa noise is eliminated when seeking zero track.
- Using direct drive spindle motor.
- Fast head seeking.
- Low profile, high performance.
- 40 tracks available.
- Stable SITL IC for outstanding performance.

Complete Set

| | Size(inch) | Type | Bus | Capacity (byte) | Track Density (TPI) |
|---|---|---|---|---|---|
| **NF-555** | 5¼ | 1D | Apple II & IIe | 250K | 48 |
| **NF-555C** | 5¼ | 1D | Apple IIc | 250K | 48 |
| **NF-051** | 5¼ | 1D | Shugart | 250K | 48 |
| **NF-502** | 5¼ | 2D | Shugart | 500K | 48 |

*Apple II, IIe & IIc are the registered trademarks of Apple Computer Inc.

Mechanism

| | Size(inch) | Type | Capacity(byte) | Track Density(TPI) |
|---|---|---|---|---|
| **F-051** | 5¼ | 1D | 250K | 48 |
| **F-502** | 5¼ | 2D | 500K | 48 |
| **F-301** | 3 | 1D | 250K | 100 |
| **F-351** | 3½ | 1D | 250K | 67.5 |
| **F-353** | 3½ | 1DD | 500K | 135 |
| **F-352** | 3½ | 2D | 500K | 67.5 |

**NEWTECH Co.LTD.**
2F, MARUZEN Bldg. 1-8-6, KANDA-SURUGADAI, CHIYODA-KU, TOKYO, 101
JAPAN. ☎03(295)8577 FAX : ☎03(293)5270 TELEX : J33255 NEWTECH

**LOS ANGELES OFFICE**
2539 W. 237 st.'E', Torrance CA 90505 ☎(213) 539-2123 TELEX : 664225 PKI TRNC

**NEWTECH COMPUTER (H.K.) LTD**
Flat D1, 14/Fl., HoiBun Ind. Bldg., 6, Wing Yip Street, Kwun Tong, Kowloon.
☎3-421272(9 Lines) TELEX : 37273 HKTXY HX

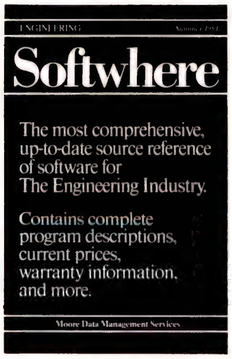
Circle 102 on reader service card

---

# READ SOFTWHERE.™ BECAUSE YOU CAN'T AFFORD TO BUY THE WRONG COMPUTER PROGRAM.

Thanks to the SOFTWHERE™ software directory, you can easily find the right Engineering computer program. It lists hundreds of programs. No directory has more.

The Engineering edition of SOFTWHERE contains only engineering-related programs. It allows fast, thorough comparisons of prices, compatible systems and hardware (micros to mainframes).



ENGINEERING Summer 1984

Softwhere

The most comprehensive, up-to-date source reference of software for The Engineering Industry.

Contains complete program descriptions, current prices, warranty information, and more.

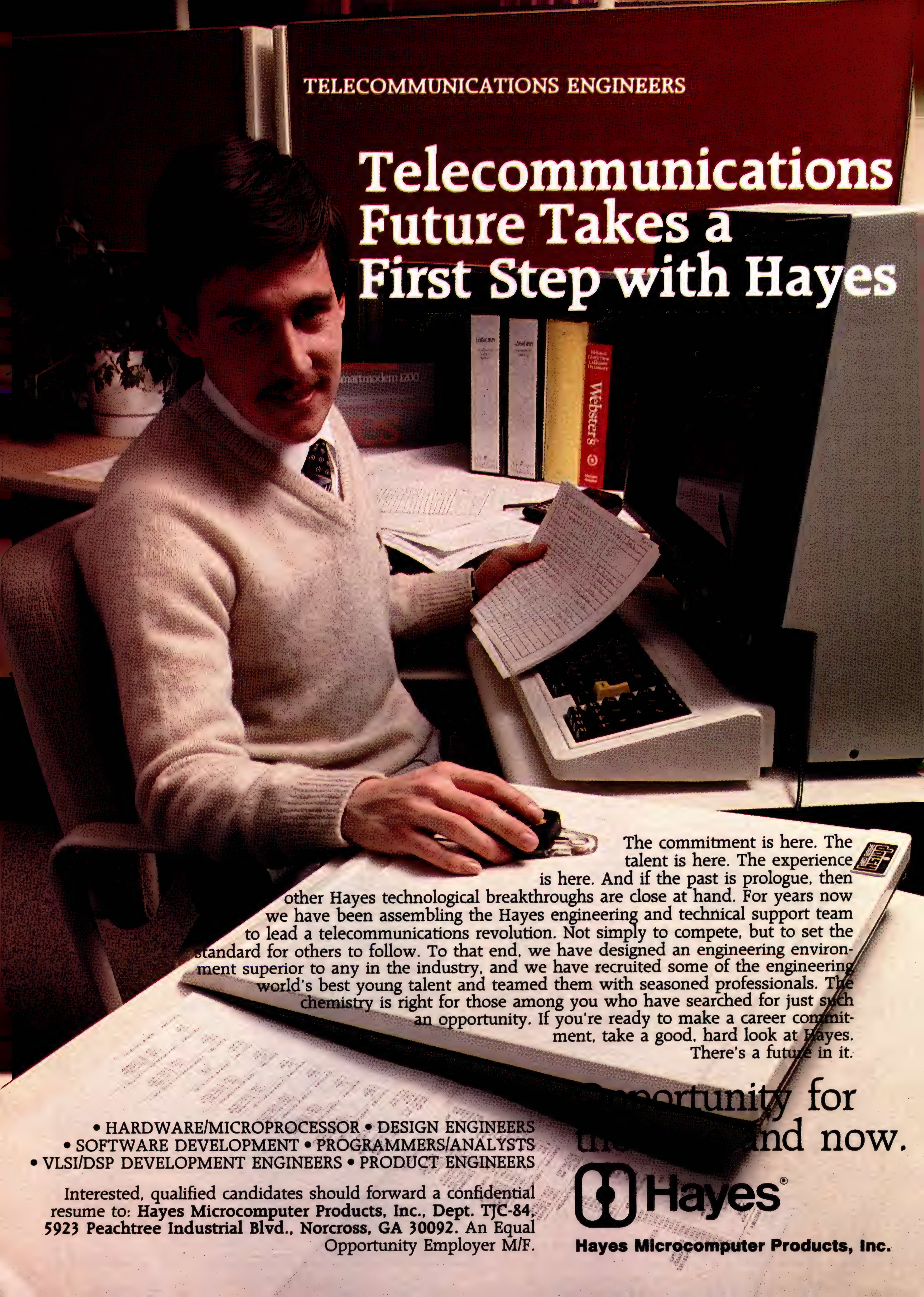
Moore Data Management Services

To order, please call
**1-800-328-5727 Ext. 6202**
(outside Minnesota) or **1-800-742-5685 Ext. 6202** (Minnesota). Phones answered 24 hours. Please send me_____copies of the Engineering edition of SOFTWHERE at $29.95 each, plus $2.95 each for postage and handling. (Please add applicable state tax).

A. My check for __________ is enclosed.
B. Please bill my
☐ Visa
☐ American Express
☐ Mastercard
Number__________
(expiration date)__________
Signature of cardholder__________
Name__________
Company__________
Address__________
Town__________ State__________ Zip__________

Send order form to:
SOFTWHERE™ Moore Data Management Services
Division of Moore Business Forms, Inc.
1660 South Hwy. 100, Minneapolis, MN 55416

Circle 103 on reader service card



TELECOMMUNICATIONS ENGINEERS

# Telecommunications Future Takes a First Step with Hayes

The commitment is here. The talent is here. The experience is here. And if the past is prologue, then other Hayes technological breakthroughs are close at hand. For years now we have been assembling the Hayes engineering and technical support team to lead a telecommunications revolution. Not simply to compete, but to set the standard for others to follow. To that end, we have designed an engineering environment superior to any in the industry, and we have recruited some of the engineering world's best young talent and teamed them with seasoned professionals. The chemistry is right for those among you who have searched for just such an opportunity. If you're ready to make a career commitment, take a good, hard look at Hayes. There's a future in it.

Opportunity for then and now.

- HARDWARE/MICROPROCESSOR • DESIGN ENGINEERS
- SOFTWARE DEVELOPMENT • PROGRAMMERS/ANALYSTS
- VLSI/DSP DEVELOPMENT ENGINEERS • PRODUCT ENGINEERS

Interested, qualified candidates should forward a confidential resume to: **Hayes Microcomputer Products, Inc., Dept. TJC-84, 5923 Peachtree Industrial Blvd., Norcross, GA 30092.** An Equal Opportunity Employer M/F.

Hayes®

**Hayes Microcomputer Products, Inc.**

ElectronicsWeek

SPECIAL REPORTS

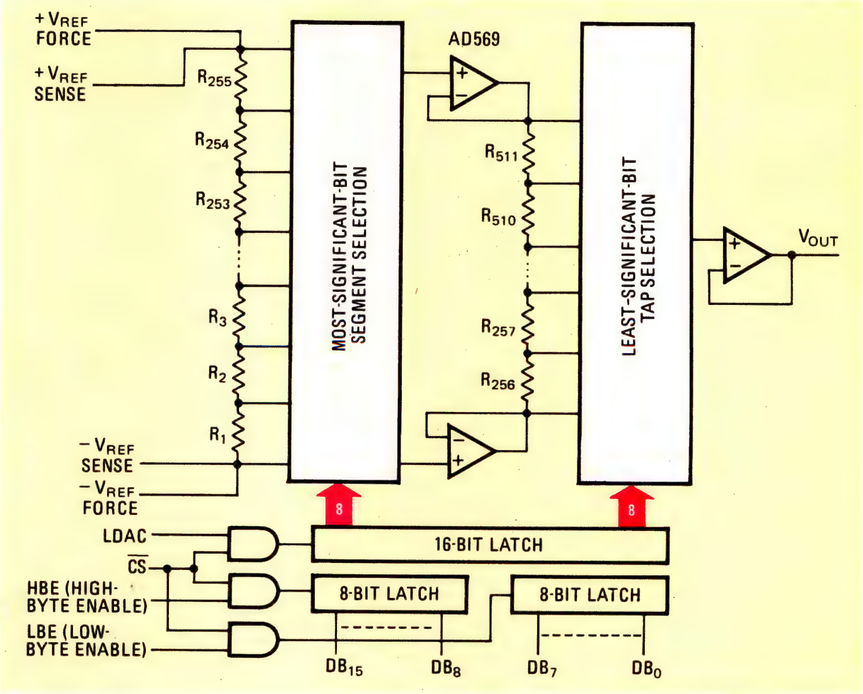
# CONVERTERS GAIN SPEED, RESOLUTION

Innovative circuit designs and improved processing techniques enhance performance of monolithic a-d and d-a converters for improved signal processing ☐ *by Ashok Bindra*

The continuously advancing field of signal processing is demanding more complex, faster, higher-resolution data converters, which perform the interfacing function between the analog and digital worlds. This challenge is being met by rapidly evolving semiconductor technology, resulting in monolithic high-performance data converters with high cut-off frequencies and high speed and resolution.

This trend toward single-chip analog-to-digital and digital-to-analog converters, however, doesn't mean the end of hybrid and modular converters. Designers are using newer complementary-MOS integrated circuits, for their dense logic, and bipolar ICs, for their precision and speed, to put monolithic converters in hybrid and modular packages, thus combining the precision and accuracy of analog circuits with the complexity of digital logic. Further, converter ICs provide the benefits of integration: decreased cost of converting data, yet finer resolution and higher speed. Such chips extend the flexibility and low noise of digital techniques to a broad range of applications.

Improvements in processing technology and circuit design are advancing the state of the art in data conversion ICs. High-speed and high-resolution converters are emerging in monolithic form to offer a number of advantages, including lower cost and additional features. Two examples are the AD7534 and AD569 from Analog Devices Inc., in Norwood, Mass. The AD7534 is a 14-bit multiplying d-a converter manufactured in linear-compatible CMOS, which permits the design of small-geometry devices using a self-aligned polysilicon gate process. This improves switching speeds because of lower device capacitance and offers greater chip density.

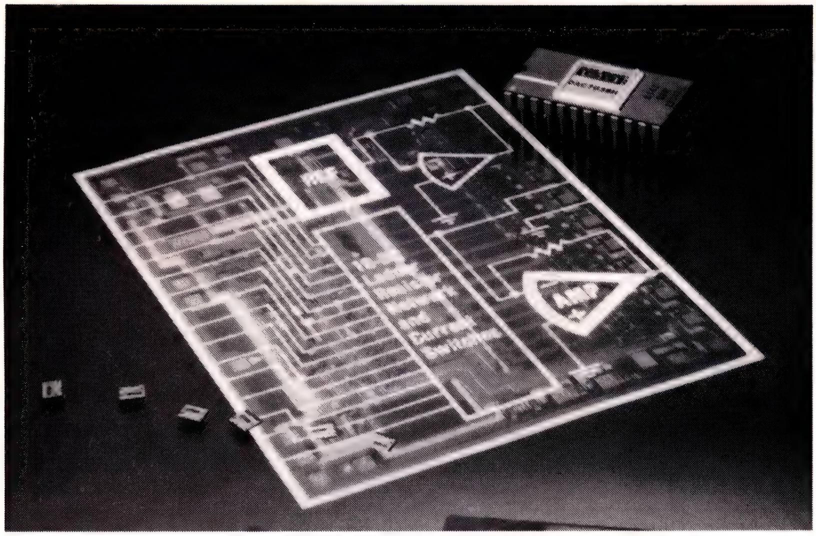


**1. Merged process.** The monolithic 16-bit d-a converter AD569 is based on Analog Devices' bi-MOS process, which combines low-power CMOS logic and high-speed precision bipolar linear circuitry on chip. The AD569's voltage-segmented architecture ensures 16-bit monotonicity without trimming.

## Excellent linearity

In addition, the converter also overcomes the leakage current across the resistor-ladder switches in the off state associated with a CMOS d-a converter. By designing a bias circuit into the converter, the AD7534's leakage current can be reduced to provide monotonic behavior over the specified operating temperature range. Excellent linearity is achieved with the use of thin-film resistors and laser trimming, and microprocessor compatibility is an added feature.

Although many look upon CMOS as the technology of



**2. Compressed.** Burr-Brown's DAC703 is a 16-bit monolithic d-a converter that settles in less than 4 $\mu$s to within 0.003% of its final value. It uses a 20-V bipolar process to fit on a single 17,300-mil$^2$ chip.

the future, it has power and speed limitations when used in linear circuits. A bipolar process, on the other hand, doesn't lend itself to linear very large-scale ICs because of its high power dissipation. Therefore, Analog Devices decided to combine the best features of bipolar and CMOS on a single substrate. According to Doug Grant, the company's new products marketing manager for converters, this bi-MOS process is going to be the answer for future-generation data converters, which will experience increasingly rigorous demands on their analog and digital performances.

For the dense logic associated with high resolution, the bi-MOS process takes advantage of low-power CMOS switches, while the bipolar process provides the high speed and precision needed in linear circuits on the same chip. Using this combined process is the AD569, a monolithic 16-bit d-a converter (Fig. 1).

Another trend, pushed more by the demands of the customers than by technology, is to add functionality to the converter, thereby reducing the user's design cost. This is apparent in 12-bit d-a converters. Analog Devices and Burr-Brown Corp., Tucson, Ariz., have recently introduced complete monolithic 12-bit d-a converters, the AD667 and DAC811, respectively. Both are self-contained d-a converters that include double-buffered input latches for microprocessor interfaces, a reference, and an output operational amplifier. Three 4-bit input latches permit interfacing to 4-, 8-, 12-, or 16-bit buses and to handle right- or left-justified data. Double buffering prevents analog outputs due to temporary intermediate digital inputs when loading from a 4- or 8-bit bus and allows multiple d-a converters to be asynchronously loaded and simultaneously updated.

Both converters are guaranteed monotonic over their respective temperature ranges—the commercial spans 0° to 70°C and military covers –55° to +125°C—and have similar gain-drift and settling-time specifications. Fast settling time and high accuracy of ±½ least significant bit over the full operating temperature range are achieved with laser-trimmed resistor networks. The settling time of the AD667 can be improved to 2 $\mu$s by using an external 20-pF compensation capacitor across the feedback resistor. The DAC811 gets its stability through the use of thin-film nichrome resistors. Temperature coefficients of 10 to 15 ppm/°C with less than 1 ppm/°C tracking is accomplished by employing automated layout projection printing and electron-beam fabrication.

One feature of the Burr-Brown converter design that has significant implications for lower cost is the use of a 20-V process, as opposed to the more conventional 40-V process used in many analog circuits. It has smaller npn and pnp transistors, which help reduce the die size. Suitable to this process are thin-film nichrome resistors, which are laser-trimmed at the wafer level. Nichrome resistors provide a low temperature coefficient of resistance and excellent long-term stability, which are necessary ingredients of a precision converter. The company's 16-bit monolithic d-a converter DAC703 (Fig. 2) uses this process to fit on a single 17,300-mil$^2$ chip.

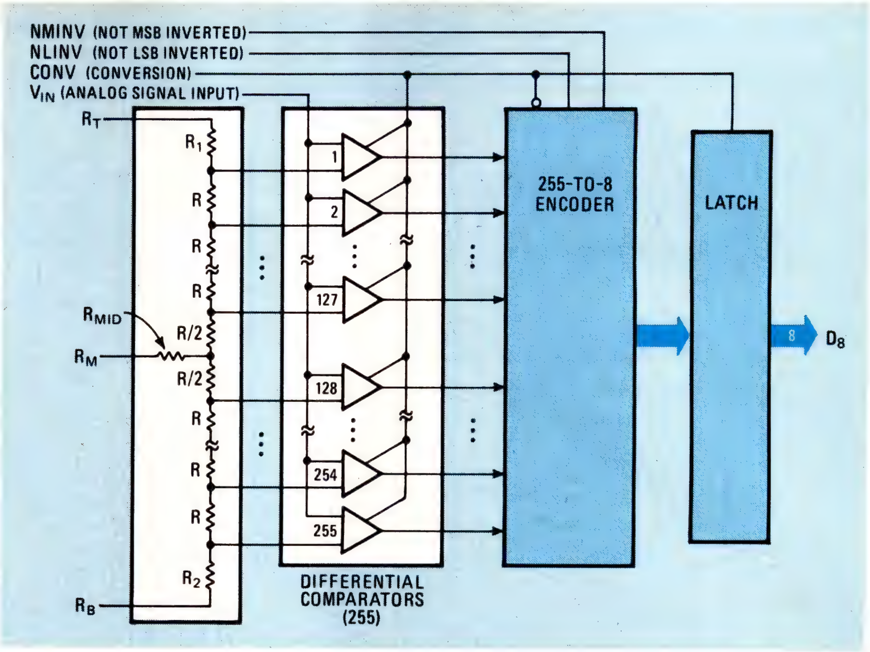
To supply a complete high-speed 12-bit d-a converter that surpasses the performance of the industry standard AD565, Raytheon Co.'s Semiconductor Division, Mountain View, Calif., developed the DAC4565. Based on a linear bipolar process, this high-speed monolithic IC gains its high performance and flexibility from a unique design and layout, a thin-film resistor process, and interactive computer-controlled laser trimming. High speed and accuracy coupled with inherent high output impedance make the DAC4565 ideal for high-speed display drivers and control systems and for a-d converters when used with the RC4805 high-speed latching comparator. The device settles to ½ LSB in 200 ns and features ±½-LSB maximum nonlinearity.

### Bipolar process is the key

Another manufacturer in the high-speed arena is TRW Inc., LSI Products Division, La Jolla, Calif. Its 8-bit TDC1018 d-a converter is capable of driving a 75-$\Omega$ load at a 125-MHz update rate. To achieve this speed, TRW uses a 1-$\mu$m bipolar process. A 4-bit version of this, dubbed the TDC1034, will be available in the fourth quarter of this year.

Motorola Semiconductor Products Inc., Phoenix, Ariz., and National Semiconductor Corp., Santa Clara, Calif., are also major contributors to the high-speed, high-resolution data conversion field. By incorporating 12 precision, high-speed bipolar current steering switches, a control amplifier, thin-film resistor network, and buried zener voltage, National's DAC1265 provides a 12-bit bipolar d-a converter that settles to less than ½ LSB in 200 ns, guarantees 12-bit monotonicity over temperature, and has on-chip voltage reference. A 12-bit version that makes use of an external voltage reference is DAC1266. To produce high-volume low-cost converters, National has adopted 5-in. wafers in its production line. Motorola, which is utilizing bipolar technology to make converters ideal for cathode ray tube displays, precision instruments, and data acquisitions and robotics systems,

**3. Flash.** The new addition to the TRW LSI Products' family of flash analog-to-digital converters is the TDC1048. This 20-megasamples-per-second full-parallel converter is able to convert an analog signal with frequency components of up to 7 MHz into 8-bit digital words.



is also in this race. Soon to join Motorola's 12-bit d-a converter family will be the MC3412/3512. Active laser trimming of thin-film ladder network, reference, span, bipolar offset, and bandgap resistors at wafer level enable the chip to provide high accuracy and linearity of better than ±½ LSB. A typical fast settling time of 200 ns is the result of an innovative bit-switching scheme.

Low leakage, compared with the metal-gate CMOS process, and ½-LSB accuracy are features of the 10-bit (PM7533) and 12-bit (PM7541) d-a converters from Precision Monolithics Inc. of Santa Clara, Calif. The company attributes these features to its silicon-gate oxide-isolated CMOS process.

Though some firms are seeking improved processes to enhance the converter performance, others are refining circuit design techniques to improve their products. Micro Power Systems Inc., Santa Clara, and Harris Corp., Melbourne, Fla., for example, are taking advantage of a design trick called segmentation to guarantee monotonicity without trimming. In the traditional ladder network approach, the resistors in the most-significant-bit section must match and track to a tightness greater than the converter's differential linearity to ensure the chip's monotonicity. In the segmentation approach, however, the converter's MSB current contributors are divided into n sections, thereby reducing each resistor's influence on the output. As a result, the matching requirements are lowered by a factor of 1/n. Embodying this approach are Micro Power Systems' MP7614 and MP7616, which are CMOS-multiplying d-a converters featuring 14- and 16-bit resolution, respectively. The MP7614 guarantees 12-bit monotonicity over commercial, industrial, or military temperature ranges, and the MP7616 guarantees 13-bit monotonicity. Harris's 16-bit d-a converter, the HI-DAC16, also uses a segmentation technique to ensure monotonicity. This circuit technique is also implemented in Analog Devices' AD569 to make a monotonic 16-bit d-a converter.

Harris's dielectric isolation process coupled with its output amplifier circuitry have come together in a new monolithic, voltage-output 12-bit d-a converter. The HI-5690V is more than twice as fast as the industry standard DAC80. The process reduces internal parasitics to provide fast switching time and minimum glitch.

Britain's Plessey Semiconductors, in Swindon, is tapping an innovative circuit design, in conjunction with a high-speed digital process, to achieve desired accuracy and monotonicity without postprocess trimming [*Electronics,* June 14, 1984, p. 144]. Unlike most d-a converters, Plessey's SP9770B 10-bit d-a converter does not use an R-2R ladder network. Instead, it has an array of transistor-resistor current sources connected with appropriate weightings for speed, accuracy, and a low-glitch output. The chip can convert a digital signal into an analog voltage at a rate of about 75 megabits/s and settle in 12 ns.

By far the most popular a-d conversion technique in general use for moderate to high-speed applications is the successive-approximation type. Here, CMOS technology is steadily encroaching on territory that only a few years ago was ruled by bipolar. Low power consumption and dense logic make CMOS a popular choice.

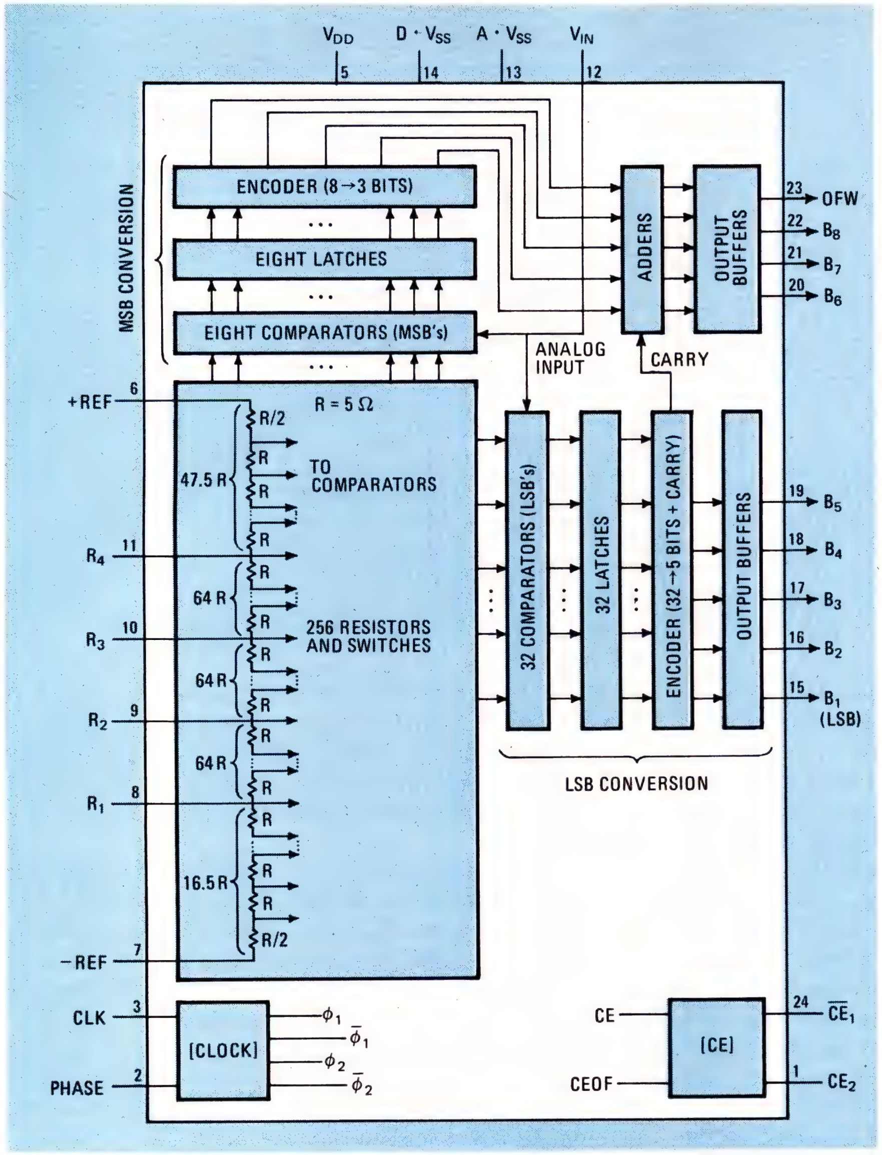
## Choice of configurations

For example, National Semiconductor has developed an 8-bit CMOS successive-approximation a-d converter with an accuracy of ±½ LSB. The microprocessor-compatible ADC0844 features four multiplexed analog inputs that can be configured in single-ended, differential, or pseudo-differential modes. In addition, it converts in 40 μs and can operate from the control bus of a wide variety of 8080 microprocessor derivatives.

Another contender in this realm is Signetics Corp., Sunnyvale, Calif., which is making its entry with the ADC08XX series successive-approximation chips in silicon-gate CMOS technology. The 25-μs converters feature on-chip clocks, differential inputs, and ratiometric measurements.

Capitalizing on its CMOS expertise is Texas Instruments Inc., Dallas. Its newer a-d converters utilize silicon-gate LinCMOS technology, which is compatible with linear TTL, to deliver two new a-d converter families, the TLC532A and TLC540. Both are 8-bit successive-approximation types with multiplexed inputs and microprocessor compatibility. The only difference is that the 532A has eight parallel outputs, while the 540 has one serial output.

A recent introduction that is bursting with features is Analog Devices' AD670, a complete 8-bit signal-conditioning successive-approximation a-d converter that in-



**4. Fast.** The MP7683 complementary-MOS 8-bit monolithic analog-to-digital flash converter, from Micro Power Systems, has a 5-MHz sampling rate and dissipates 75 mW. It performs conversions in two steps, with the first step converting 3 most significant bits and the second 5 least significant bits.

cludes an instrumentation amplifier and a precision voltage reference on chip. Operating from a single 5-V supply, the chip provides four differential input ranges, converts in less than 10 μs and allows direct interfacing with a variety of tranducers. Unlike conventional converters, the AD670's successive-approximation function is implemented with an integrated-injection-logic delay line, which needs no clock.

Successive approximation has also seen a spurt of activity in the 12-bit and higher resolution arenas. The proliferation of these parts into a wide variety of applications promises to open up new markets in automotive, industrial, telecommunications, and military applications.

Analog Devices' contribution to this burgeoning market is the AD7582, a medium-speed, four-channel 12-bit monolithic CMOS a-d converter that uses successive approximation to provide a conversion time of 100 μs per channel. Additional features include easy microprocessor interfacing and an auto-zero cycle for low offset voltage. Adding to these high-resolution monolithic converters is National Semiconductor. Its 12-bit plus sign successive-approximation a-d converters, the ADC1205 and ADC1225, operate from a single 5-V supply, with the 1205 suitable for an 8-bit bus and the 1225 available for 16-bit buses.

Another class of a-d converter that affords linearity at the cost of speed is the integrating type. As the name implies, its output represents the integral or average of an input voltage over a fixed period of time. As a result, the integrating type gives repeatable results in the presence of high-frequency noise. In addition, since quantization is a function of time, linearity is excellent, with no possibility of missing output codes. Because of these characteristics, such a-d converters find use in digital panel meters, multimeters, and other slow measurement applications.

Intersil Inc. of Cupertino, Calif., is dedicated to making high-performance integrating a-d converters. One recent addition to its line is the ICL7109, a 12-bit a-d converter. Using a dual-slope technique, this chip provides the user with high accuracy, a drift of less than 1μV/°C, low noise, and a power consumption of only 20 mW.

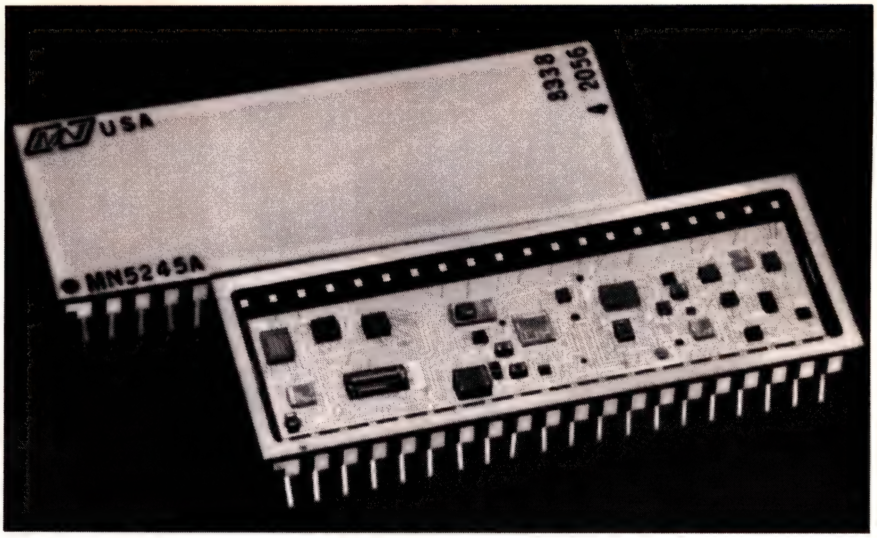
Another method, known as charge balancing or quantized feedback, is based on the principle of generating a pulse train with frequency proportional to the input voltage and then counting the pulses for a fixed period of time. Teledyne Semiconductor, Mountain View, is using it to make high-resolution a-d converters that combine accuracy, linearity, and noise immunity on one chip. The firm's TSC8705, a 12-bit monolithic CMOS a-d converter, uses this technique.

## Flash converters for real speed

For ultrafast a-d conversion, a different technique, known as flash or parallel conversion, is used. Because only two sequential conversions are required in a parallel design, the flash a-d converter is faster than either a successive-approximation or an integrating converter. In addition, they also serve as building blocks for higher-resolution hybrid and modular products. The decreasing cost of converting data at 8-bit or finer resolution is extending flash converters into video-digitizing, robotics, image processing, ultrasound, and radar applications.

The new addition to the TRW LSI family of flash a-d converters is the TDC1048. This monolithic 8-bit full parallel a-d converter (Fig. 3), based on a 1-μm bipolar process, substantially cuts its predecessor's power consumption to less than 1.5 W. Capable of sampling at 20

**5. Hybrid.** Guaranteeing no missing codes over its entire specified temperature range, the MN5245 from Micro Networks combines resolution, speed, size, and cost. The 12-bit analog-to-digital converter achieves 900-ns conversion time using a serial to parallel conversion technique.



MHz, the TDC1048 can convert an analog signal with full-power frequency components up to 7 MHz. Later this year, the company plans to introduce a 7-bit version, the TDC1047. Sampling at 20 MHz, it dissipates 850 mW.

Speaking of low power consumption, the 41051, an 8-bit CMOS flash a-d converter from RCA's Solid State Division in Somerville, N.J., dissipates less than 150 mW when operated from a single 5-V supply at a clock frequency of 15 MHz. This intrinsic high conversion rate makes the 41051 ideally suited for digitizing high-speed signals. With the help of the overflow bit, two 41051s may be connected in series to produce a 9-bit high-speed converter or may be operated in parallel to double the conversion speed.

Another company making 8-bit a-d flash converters in a CMOS process is Micro Power Systems, whose model MP7683 (Fig. 4) executes 8-bit conversion in 200 ns and consumes only 75 mW. When cascaded in series, the unit's overflow bit allows for 9-bit resolution. Besides citing the two-step conversion, the company attributes the unit's performance to a self-aligned refractory-gate (molybdenum) CMOS process. Refractory molybdenum gate used as a first-layer metal interconnection further improves the circuit density and speed without any tradeoffs.

Using a silicon-gate CMOS process in conjunction with a one-step conversion technique is the TML1073 from Telmos Inc., Sunnyvale. Though the 7-bit flash a-d converter is designed to dissipate 150 mW at a 7-MHz sampling rate, operating the converter at 3 MHz slashes power consumption to only 50 mW.

In contrast to the preceding units, Siemens 6-bit flash a-d converter, dubbed the SDA5200, uses emitter-coupled-logic technology for a sampling rate of 100 MHz. It comes in two versions—the 5200N and 5200S—that differ only in output codes when the overflow is active.

Yet another addition to the expanding line of monolithic flash converters with ECL compatibility is the AD9000, a 6-bit flash a-d converter from Analog Devices. Capable of a 75-MHz minimum word rate, the AD9000 uses 64 parallel comparators to digitize fast-moving analog input signals without the need for external track and hold circuits. It provides an overflow bit that can be used for connecting multiple units in a cascade arrangement. For faster monolithic flash a-d converters, Motorola Semiconductor Products sector in Phoenix, is banking on its MOSAIC (Motorola's oxide self-aligned implanted circuit) process. Based on this process is the MC10319, an 8-bit flash a-d converter with a 25-MHz sampling rate, to be introduced early next year.

High-speed data converter development has also seen a spurt in Japan. The driving force is the increasingly important role of such devices in the digitization of high-resolution video pictures. Matsushita Electric Industrial Co., Osaka, recently announced the development of an 8-bit flash a-d converter, the AN8108, that digitizes a 40-MHz signal at 120 megasamples/s. By using a three-stage comparator circuit instead of a two-stage circuit, the leakage of the clock signal into the analog circuit is cut by a factor of 25. In addition, a switching current source is used in the encoder circuitry in order to reduce power consumption while maintaining the high-speed capability. The company attributes the converter's low offset voltage and high yield to a 2-μm bipolar process that uses double ion implantation.

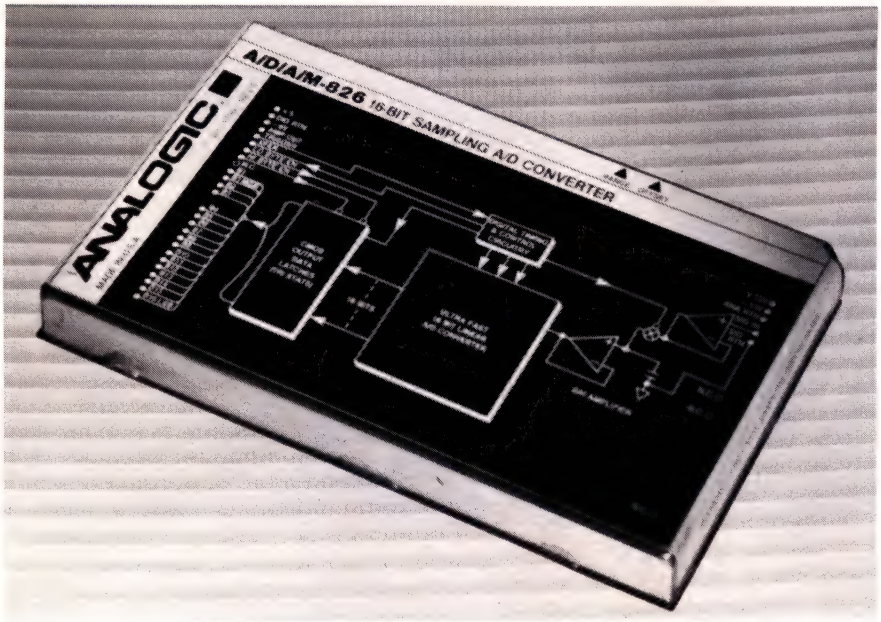
A slightly slower model is the CX20116 from Sony Corp., Tokyo. With a sampling rate of 100 megasamples/s, it consumes only about 1.2 W and is linear to within ±½ LSB. The company claims that by changing the process parameters, it can make devices with a maximum sampling rate of 150 megasamples/s, but at the cost of higher power consumption.

## Hybrids incorporate newer ICs

Although monolithic chips are replacing hybrid and card-level converters, the multichip circuit makers are exploiting the capabilities of the new ICs by incorporating them into hybrid and modular products to surpass the monolithics in performance. In addition, automated assembly methods are substantially cutting the manufacturing costs of hybrid and modular parts.

This trend is manifested in Analog Devices' HAS1409 a-d converter and HDD1409 d-a converter. The hybrid technique puts together high resolution and high speed in one package. Both units offer 14 bits of resolution with conversion rates of up to 125 KHz and 200 KHz, respectively. To ensure 14-bit accuracy, the HAS1409 contains an internal track-and-hold circuit, which eliminates the need for an expensive external one. In applications such as digital communications, digital signal processing, medical imaging, and pulse code modulation, the 14-bit dynamic range and high conversion rates make the HAS1409 and HDD1409 cost-effective competition for modular products.

In the 16-bit resolution range, Burr-Brown's ADC76 is



**6. Modular.** Available with or without input buffer or sample-and-hold amplifier configurations, Analogic's ADAM-826 is a 16-bit, 1.5-µs analog-to-digital converter that guarantees 16-bit monotonicity over a specified temperature range. Power dissipation ranges from 2.75 W for 826-3 to 3.5 W for 826-1.

a 16-bit successive-approximation a-d converter that uses laser-trimmed thin-film components in a hybrid package. A 16-bit hybrid that combines the advances in linear technology with the economy of semicustom logic arrays is the company's DAC708/709. This 16-bit d-a converter uses bipolar technology for high precision and high accuracy, since transistors can be matched very precisely in this process, and CMOS logic for low power and high logic density. Though the 708 is a voltage-output unit and the 709 is a current-output unit, they both guarantee 14-bit monotonicity over the entire specified temperature range.

Micro Networks Co., Worcester, Mass., is concentrating on the development of a-d converters with resolutions of 12 bits or more and a conversion time faster than 2 µs. Two such recently announced products are 12-bit a-d converters, the MN5245 and the MN5246. Both are 900-ns converters that guarantee 1-MHz throughput rates (Fig. 5). The firm attributes this speed to a serial to parallel conversion technique.

In the works at Micro Networks is a 16-bit CMOS unit that combines bipolar and CMOS chips on a single substrate. This hybrid unit promises 15-bit performance over the specified temperature range of –25 to +85°C. Its conversion time is specified as 50 µs.

Another contributor committed to hybrid technology is Hybrid Systems Corp., Billerica, Mass. Its model HS9516 is a 16-bit a-d converter with true 16-bit linearity. This hybrid package is a completely self-contained unit with a 100-µs conversion time and six user-selectable input ranges.

Serving both military and industrial needs is ILC Data Device Corp., Bohemia, N.Y. The ADC00403, which is manufactured to four military specifications, is the latest addition to its line of low-cost 12-bit a-d converters. This successive-approximation converter is a high-speed version of the industry standards ADC85 and ADC87. Featuring 2-µs conversion time, a wide temperature range and a small hermetic hybrid package, the company says that the unit is ideal for many industrial and military data conversion applications.

Taking advantage of a process known as Monobrid, which is a combination of monolithic and hybrid technologies, ILC Data Device's ADH-030 II is a 12-bit 35-ns hybrid d-a converter that consists of a single IC, thin-film resistors, and decoupling capacitors. Going higher up in the resolution range are 14- and 16-bit d-a converters, the DAC-02310 and DAC-02900. Though the 14-bit model is a combination of high resolution, fast settling and low glitch performance, the 16-bit unit converts in 15 µs and offers 16-bit linearity.

To further surpass the performance of the hybrids, the next logical step is modular converters. These converters use monolithic and discrete chips and hybrids to combine resolution, speed, precision, and accuracy with greater functionality. Such a combination is impossible with monolithic converters and is expensive to achieve with hybrids alone.

One such part is Analogic Corp.'s ADAM-826 (Fig. 6). This 16-bit, 1.5-µs a-d converter samples at a rate of 500 kHz, and guarantees 16-bit monotonicity over a 0-to-70°C temperature range.

Offered in three input configurations, the ADAM-826 dissipates 2.75 W for the a-d converter only, and 3.5 W for the configuration with sample-and-hold amplifier on board. The flexibility of performance typical of modular units also extends to packaging. Packaged in standard Modupac, measuring 3 by 5 in., the module is available with edge connectors and mating sockets for applications where board space is not a problem.

Supporting the modular approach is another Massachusetts, company Datel-Intersil Inc., in Mansfield. Datel's ADC868 is an ultra high-speed 12-bit modular a-d converter with a maximum conversion time of 500 ns. Furthermore, it guarantees no missing codes over a temperature range of 0-to-70°C. The unit consists of a fast-settling precision input amplifier, flash converter, high-speed d-a converter, high-speed comparator, precision voltage reference, clock generator, and control logic circuits. Complete with on-board offset and gain adjustments, it needs no external components. Zeltex Inc., Concord, Calif., is also making high-resolution converters for time- and frequency-division multiplexers.

Like their counterparts in the hybrid and monolithic businesses, the vendors of modular products are continually upgrading their products. The new monolithic ICs serve as building blocks for hybrids, which in turn serve the modular or board-level converters. Therefore, as long as there are better hybrid and monolithic parts, there will also be superior modular converters, unsurpassed in overall performance. ☐

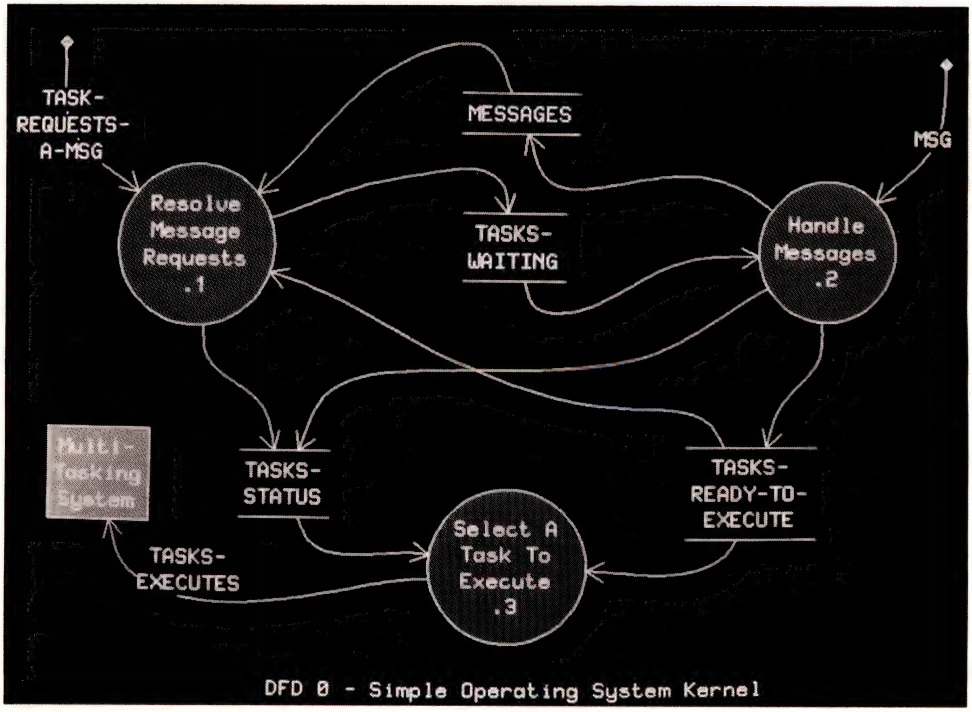
# SOFTWARE TOOLS AUTOMATE STRUCTURED ANALYSIS

To speed creation of system specifications, structured approach uses data flow diagram, minispecification, and data dictionary ☐ *by Norman L. Kerth*

Among the various phases of software development, one of the most important is specification, when engineers transform system requirements into documents describing system function. One approach, called structured analysis, helps engineers analyze the flow of data through a system and produce concise data about a system's capability. Now, with a new set of tools for computer-aided engineering software that eliminates the drawbacks related to the manual execution of the structured-analysis process, software engineers can reap the full benefits of the application of structured analysis—improved life-cycle costs, greater product reliability, and more effective project monitoring.

Structured analysis fits into a key position in the software product development cycle, which includes separate phases for specification, design, implementation, and testing. During specification, system analysts identify the system's capability. In the design phase, software engineers identify how the system will implement the specifications. The final two phases deal with implementing, testing, and evaluating the software programs as they correspond to the original specification. Structured analysis comes into play during specification, providing a means to analyze the requirements and functional capability of the system under development.

Without such a disciplined model, functional specifications tend to be long, often poorly organized narrative documents. Their length adds to engineers' difficulties in updating them or finding omissions or inconsistencies among several documents. Furthermore, the specifications are hard to understand and even harder to use for the actual design process.

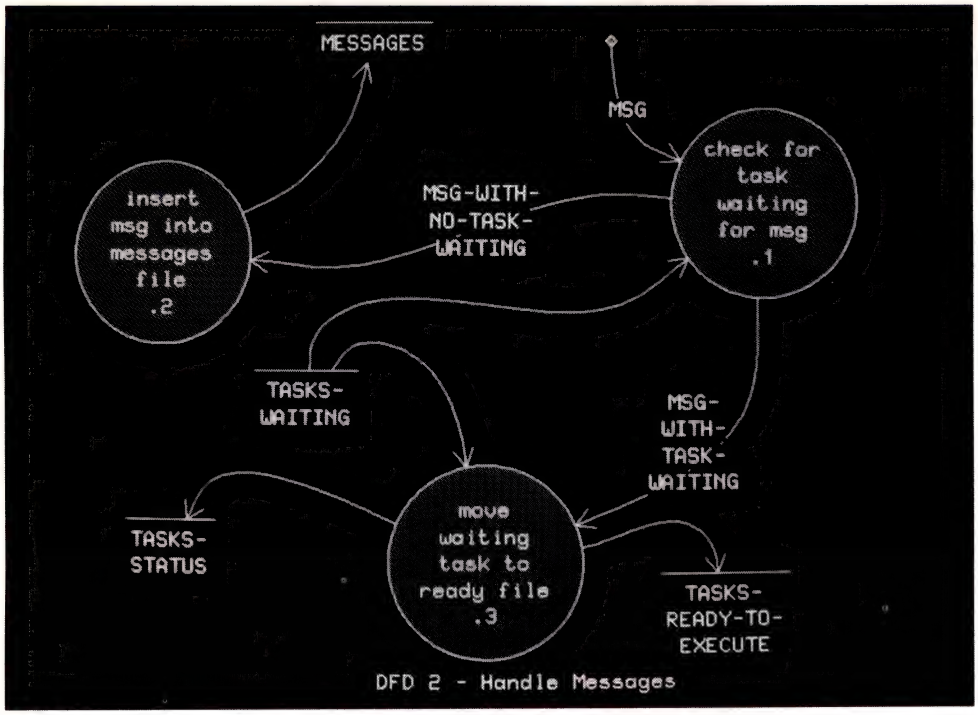


**1. Simple kernel.** Structured analysis focuses on information flow in an operating system. In this system kernel, data flows (arrows) between processes (circles), which communicate with data structures, or files (horizontal bars).

## Graphical representation

Structured analysis replaces this conventional textual specification with one that is predominantly graphical. The benefits of a clear, thorough specification are especially significant for complex systems and systems developed under military contract—where specifications are often the only communication that takes place between system analysts and designers.

In structured analysis, an engineer views a system in terms of what information it will handle and how the



**2. Message handler.** Child data flow diagrams give further details about a process. Because its parent data flow diagram has already referenced the files, this child diagram uses single horizontal lines to indicate files.

information will be transformed as it flows between input and output. Part of the advantage of structured analysis is its way of controlling complexity. Because it is a hierarchical method, an engineer can use it to decompose a single large system into a number of smaller and more precisely defined subsystems. Consequently, structured analysis encourages software developers to iteratively break down a complex problem into subproblems until each can be clearly understood.

Structured analysis also encourages an engineer to focus on the task of specification—that of determining what a system is supposed to do. Often, engineers will approach specification with an eye on the system's eventual implementation—and often introduce design constraints that are tied solely to its implementation. With structured analysis, engineers can confine implementation details to the design phase.

In performing structured analysis, engineers produce three types of documents:

- A data flow diagram, which shows the data flowing into and out of a system (or subsystem), and transformations, which operate on the data. In turn, either another data flow diagram, called a child data flow diagram, or a minispecification describes each transformation.
- A minispecification, which describes the processing necessary to convert the input data flows into output data flows.
- A data dictionary, which defines the composition of each data flow mentioned in a data flow diagram.

In structured analysis' graphical approach, software designers create data flow diagrams for the various levels of a system. For example, one diagram describes the top-level flow in a simple operating system kernel (Fig. 1). In a data flow diagram, each circle, or bubble, represents a process and each arrow represents a data flow. A file is indicated by horizontal bars—two bars the first time a file is used and only one for subsequent references. Individual numbers identify the data flow diagram itself and each process in it.

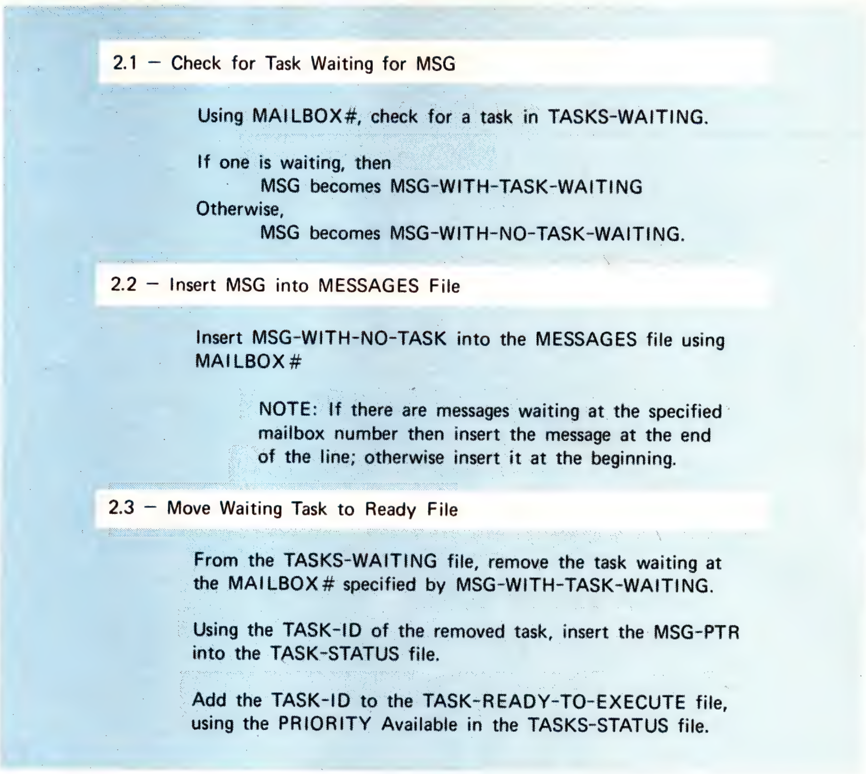
In this simple example, the operating system kernel allows tasks to request and send messages and also decides which task may execute. If a task requests a message and a message is available in the Messages file, the message is moved from that file and inserted into the Tasks-Status file, and the task that requested the message is permitted to continue executing. If no message is waiting for the requesting task, then the task's status is saved in the Tasks-Status file, and the task is removed from the Tasks-Ready-To-Execute file and placed in the Tasks-Waiting file.

If a task sends a message (to a mailbox called Msg) and another task is waiting for that message, then the waiting task is removed from the Tasks-Waiting file and placed in the Tasks-Ready-To-Execute file, and the message location (Msg-Ptr) is placed in the Tasks-Status file. On the other hand, if no task is waiting for the message, then the message is placed in the Messages file until a task requests it.

In determining which task will execute, the kernel simply selects the highest priority task in the Tasks-Ready-To-Execute file. This task's correct status is restored from the Tasks-Status file—all the machine registers, status registers, and the stack pointer are set properly so that the task can continue to execute from where the operating system kernel stopped it.

## Child diagrams

In structured analysis' next step, engineers create second-level—or child—data flow diagrams from the top-level flow diagram. A key point in structured analysis is that data flows must be consistent between parent processes and child data flow diagrams or minispecs. So, for example, the data that flows into and out of a child data flow diagram is the same data that flows into and out of the parent process that described it (Fig. 2). Furthermore, the title of the child data flow diagram has the same name and number as its parent process—a key step in maintaining consistency between documents. Each process in data flow diagram 2 in the example is identified by the parent number (2) along with its own unique number (2.1, 2.2, and so forth). Because files in data flow diagram 2 have already been referenced in data flow diagram 0, a single bar designates files in data flow



```
2.1 - Check for Task Waiting for MSG

        Using MAILBOX#, check for a task in TASKS-WAITING.

        If one is waiting, then
                MSG becomes MSG-WITH-TASK-WAITING
        Otherwise,
                MSG becomes MSG-WITH-NO-TASK-WAITING.

2.2 - Insert MSG into MESSAGES File

        Insert MSG-WITH-NO-TASK into the MESSAGES file using
        MAILBOX#

                NOTE: If there are messages waiting at the specified
                mailbox number then insert the message at the end
                of the line; otherwise insert it at the beginning.

2.3 - Move Waiting Task to Ready File

        From the TASKS-WAITING file, remove the task waiting at
        the MAILBOX# specified by MSG-WITH-TASK-WAITING.

        Using the TASK-ID of the removed task, insert the MSG-PTR
        into the TASK-STATUS file.

        Add the TASK-ID to the TASK-READY-TO-EXECUTE file,
        using the PRIORITY Available in the TASKS-STATUS file.
```

**3. Mini specification.** Although minispecifications can be written in free-form text, they often use an English-like pseudo-programming language to describe the low-level transformations that occur to data in data flow diagrams. They should list all data that flows into and out of the process it defines.

diagram 2. After processes such as those in data flow diagram 2 have been decomposed into primitive terms, an associated minispec provides further description (Fig. 3). Like the lower-level data flow diagrams, the minispec should mention all the data that flows into and out of the process it defines. Although they are free-form descriptions, minispecs generally employ a structured English-like pseudo-programming language in order to describe data transformations.

In structured analysis, the data dictionary defines each piece of data in the target system. Ideally, the engineer constructs the data dictionary while developing the data flow diagrams, rather than after they are completed. The process of building the data dictionary assures the engineer that the data structures are fully understood. If the engineer has trouble defining the data, it should serve as a warning sign to stop and reexamine the specification.

The syntax for a minispec is similar to that used in the Backus-Naur Form notation, using metasymbols such as curly brackets to indicate iterations of elements and the plus sign to indicate concatenation of structures. For example, a Msg in the example is composed of a Msg-Ptr and a Mailbox# (Fig. 4). The Tasks-Waiting data structure, on the other hand, includes a number of pairs of Task-Id and Mailbox# elements. Furthermore, this notation uses "0" and "n" in the definition of Messages to indicate that a mailbox can hold between zero and "n" messages at any one time, implying that messages are stored in some sort of data structure.

## Class of problems

Just as one transistor model can't handle all the situations an electrical engineer encounters, the structured analysis method cannot satisfy all classes of software problems that designers face. It is a good general-purpose software-modeling technique, however, that is applicable to most problems and is particularly effective in dealing with problems loaded with data transformations. For example, most embedded systems applications include data transformation requirements and process control requirements. Because structured analysis intentionally avoids dealing with control-flow information in its data flow diagrams, structured analysis is good for those applications in which data transformation—rather than control flow—is the most complicated (or least understood) part of the system.

Although they are certainly important items, interrupts and feedback loops, for example, are considered issues of how the system works—not what it does. Consequently, these issues are avoided during structured analysis and handled instead during the design phase. Structured analysis helps engineers think about what such structures are used for. Thus, rather than adding an interrupt to a data flow diagram, an engineer should think of an interrupt as adding new data to the system—represented as a new source of data in the data flow diagram.

## Control information needed

If no new data enters the system as a result of the interrupt, however, the engineer should think about ways to implement the system without that interrupt. After exploring these possibilities, the engineer is likely to agree that the interrupt is a design issue and best left for the design phase. Nevertheless, the goal of any model is communication. Consequently, as a final possibility, some instances dictate violating the rules of structured analysis and adding some control information to the data flow.

Until recently, structured analysis has been executed manually, which had enough drawbacks to overshadow the method's benefits. The task of manually creating the structured analysis documents can be tedious. Moreover, because the documents are created early in the design cycle, ideas and details inevitably change—requiring a corresponding change in documentation. The process of maintaining the documents—keeping them current and cross-checking them for consistency—can be a source of error, particularly on large products that involve many structured-analysis documents.

To eliminate the drudgery and errors that plague manual implementation of structured analysis, Tektronix has developed tools that automate those portions of the method that could be done by a computer—leaving for humans only those aspects that require creativity and

Files :

MESSAGES = { MAILBOX# + o{ MSG-PTR }n }

TASKS-READY-TO-EXECUTE = { TASK-ID + PRIORITY }

TASKS-STATUS = { TASK-ID + CURRENT-STATE + ( MSG-PTR )
+ PRIORITY }

TASKS-WAITING = { TASK-ID + MAILBOX# }

Data Flows:

CURRENT-STATE = data-registers + address- registers
+ status-register + stack-ptr

MAILBOX# = integer

MSG = MSG-PTR + MAILBOX#

MSG-PTR = integer

MSG-WITH-NO-TASK-WAITING = MSG

MSG-WITH-TASK-WAITING = MSG

PRIORITY = integer

TASK-REQUESTS-A-MSG = TASK-ID + MAILBOX#

TASK-ID = integer

**4. Data dictionary.** In the structured-analysis decomposition of a software system, the data dictionary describes all the files and data items referenced in the data flow diagrams and minispecifications. The process of building the data dictionary assures the engineer that the data structures are fully understood.

ingenuity. For example, a computer can find inconsistent use of a data flow among several related data flow diagrams, but humans are better at naming the process bubbles and positioning them on the diagram. Growing out of the internal application of structured analysis that began in 1978, these tools have been used internally since fall 1981. A primary development focus was that they should be easier to use than not to use.

To determine what portions of structured analysis could be automated effectively, the method itself was used to analyze how an engineer interacts with structured analysis documents. The study lead to the creation of automated tools that alleviate much of the tedium of manually creating and modifying structured analysis documents and that report or correct many common errors. In particular, the structured-analysis tools support three major functions—creating and modifying structured analysis documents, evaluating documents and reporting certain errors, and correcting some errors.

Although a standard text editor can handle data dictionaries and minispecs, an interactive graphics editor, called a DFD Editor, handles the particular graphic requirements of structured-analysis diagrams. Because the editor uses the vocabulary of structured analysis, a designer can both think and work in terms of processes and data flows—rather than in terms of circles and lines, as with a conventional general-purpose graphics editor.

Furthermore, to help ensure the correct construction of data flow diagrams, the DFD Editor enforces a number of structured-analysis syntax rules. For example, when a designer creates a process, data flow, or file, the editor issues prompts for the name, origin or destination, or label, respectively, for each item—and rejects entries that conflict with the current data flow diagram.

The structured-analysis tools also evaluate the structured-analysis documents to find interface conflicts and inconsistencies as well as violations of the structured analysis method. The tools report errors. If only one way exists to correct the error, the tools make the correction—such as changing a child's title to agree with the parent, setting correct file levels, or deleting dictionary entries that aren't referenced in any data flow diagram or minispec.

Design teams using structured analysis and tools have seen a number of improvements in the reliability and maintainability of their products and in the development process. The use of structured analysis boosts product quality and reduces life-cycle costs, both because many errors are uncovered early in the life cycle—when the cost of fixing errors is lower—and because the system is better understood.

Besides being more reliable, products developed under structured analysis are easier to extend and update. The engineer can modify the model and see the implications of a change early, rather than changing the product and encountering unanticipated side effects. In addition, because structured analysis is based on sound principles of top-down decomposition, the partitioning of the software is usually very clean.

## Better understanding

Structured analysis leads to improved communication among design team members by providing a standard notation to express ideas. This is especially important because it is used in the early phases of a project, when the system is least understood. It makes it easier for software engineers to communicate their thoughts and get early feedback. Software engineers can exchange views and ideas using structured-analysis drawings, much as electrical engineers might use circuit schematics. Furthermore, concise and complete drawings provided by the method can also help protect a project from the problems of personnel turnover. The drawings help new engineers become familiar with the project more quickly.

Another beneficial side effect of structured analysis is that the project manager has better information on which to base decisions. Structured analysis gives the manager a firmer, more precise basis for costing the project, establishing schedules, and evaluating progress. ☐

---

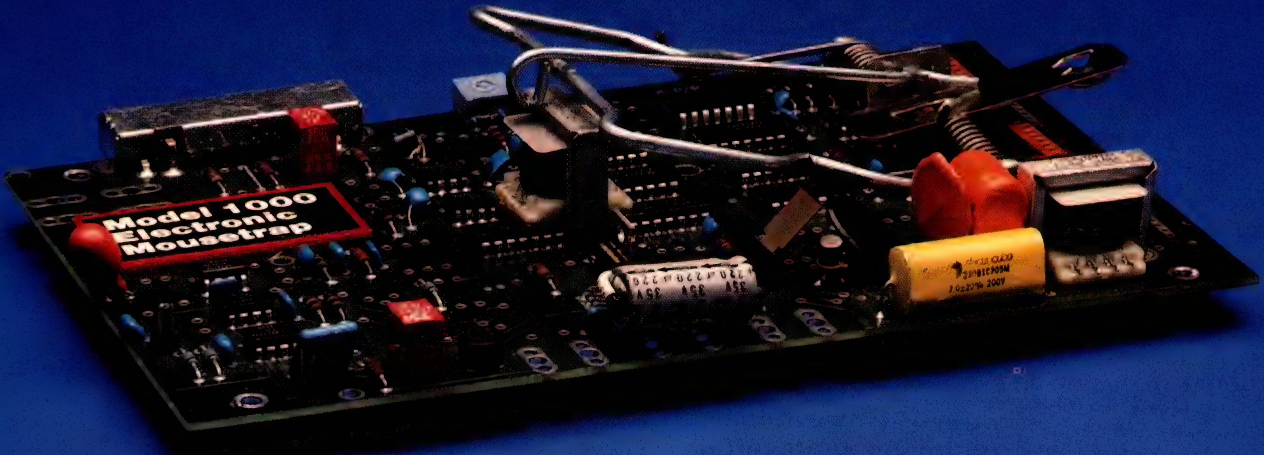
For more information on the basics of structured analysis, see:
T. DeMarco, Structured Analysis and System Specification, Yourdon Press, New York, 1978.
C. Gane and T. Sarson, Structured Systems Analysis: Tools and Techniques, Prentice-Hall, Englewood Cliffs, N.J., 1979.
S. McMenamin and J. Palmer, Essential Systems Analysis, Yourdon Press, New York, 1983.

---

*Norman L. Kerth is with Tektronix Inc., in Beaverton, Ore.*

**“If you make a better mousetrap, the world will make a beaten path to your door.”**

Ralph Waldo Emerson, 1855



**“If you design a better mousetrap, the world won’t necessarily make a beaten path to your door.”**

ElectronicsWeek, 1984

# In the electronic Eighties industry needs better decisions not just better designs.

Electronics, the world's most dynamic industry, is changing. And Electronics, the magazine that covers the industry, has been changing right along with it.

**Ralph Waldo Emerson was wrong.**

Better designs are no longer the only keys to success. In the electronic Eighties a company must make better decisions. And they can only be made consistently by industry professionals who are well informed.

Today, good technical and business decisions must be based on a broad understanding of where the industry is. And where it's going.

In other words, with the kind of insight that only a classic industry publication like Electronics provides.

**More disasters to come?**

The bankruptcy of Osborne, and RCA's $580-million videodisc write-off are just the tip of the iceberg. More possible disasters lie hidden in the future.

And they can only be prevented by decision makers who, regardless of discipline, possess the most complete, accurate and current industry information available.

This is the
last issue of
Electronics.

JULY 12, 1984

MICROCOMPUTER WORLD NERVOUSLY AWAITS IBM'S PC II/83

Fast 32-bit Futurebus anticipates new architectures/108

Active matrix addressing improves flat-panel displays/113

SIX DOLLARS A McGRAW-HILL PUBLICATION

Electronics®

# Which is why Electronics is now ElectronicsWeek.

The electronics industry is growing up. And Electronics, the voice of the industry, is growing along with it.

**We're not changing our name.**

McGraw-Hill is just adding the word "Week" to our 54-year-old "Electronics" name. From now on readers of the magazine that gave the industry its name will be able to get more of the same information, more often.

Every important industry has a powerful, authoritative weekly magazine. In the aviation industry, it's Aviation Week. In the advertising industry, it's Advertising Age. And so it goes.

**Paid, worldwide, and now weekly.**

We're paid circulation. Which is one reason we can afford ten dedicated, full-time news bureaus around the world. It's also why we can have more editors than any other publication in the field.

Our exclusive worldwide circulation attests to an excellent international editorial product. One that is more respected and relied upon than any other publication in the electronics industry.

Starting July 23, ElectronicsWeek, the voice of the industry, will be heard each week.

This is the
first issue of
ElectronicsWeek.

A McGRAW-HILL ELECTRONICS PUBLICATION JULY 23, 1984 $3

ElectronicsWeek

Memory Tester Breakthrough

CAPACITY DOUBLES/162

WORLD MARKETS RIDE A CREST/106

# Why pay more for a Programmable Audio Oscillator—

BOONTON

When the new Booton 1100 offers 20 Hz to 50 kHz frequency coverage, low distortion (typically 0.02%), variable levels to 8 volts emf with 2 mV resolution (1 mV below 4 V), separate fixed 1 V output, accuracy of 0.05%, and full GPIB capability. Easy error identification, free format number entry, and return of function arguments via interface bus make programming a snap. And the big plus—you can store up to 190 complete panel setups in non-volatile RAM for instant recall.

See your local representative or contact us directly for the details.

**Boonton Electronics Corporation**
791 Route 10, Randolph, NJ 07869
Telephone (201) 584-1077

Signal Generators ☐ Modulation Meters
RF Power Meters ☐ RF Millivoltmeters
Capacitance Meters and Bridges ☐ Audio Oscillators

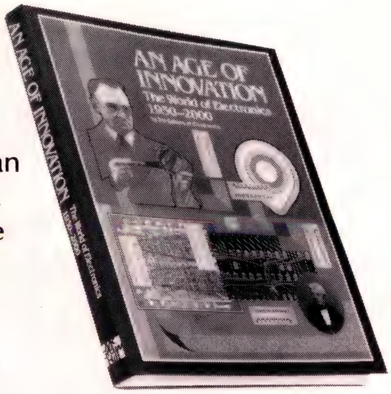
Circle 76 on reader service card

---

## *In celebration of the 50th anniversary of* ***Electronics*** *Magazine . . .*

The most exhilarating, comprehensible look at past and future developments in electronics that has ever been published.

Painstakingly researched and written, AN AGE OF INNOVATION gives you an unforgettable overview of electronics. Everything from the individuals whose foresight and daring led to the great advances . . . to the origin of specific technological breakthroughs you use in your own work and home . . . to the challenges and discoveries we will face tomorrow.



The editorial edition of Electronics' 50th Anniversary issue of April 17, 1980, beautifully clothbound and jacketed for your permanent pleasure. 300 illustrations, many in full color.
274 pages, $18.50

## AN AGE OF INNOVATION

### The World of Electronics 1930–2000

by the Editors of *Electronics*

**Order your copy today!**

**Electronics Week Books**
P.O. Box 541
Hightstown, N.J. 08520

McGraw-Hill

Send me ________ copies of *An Age of Innovation* @ $18.50 plus applicable sales tax. McGraw-Hill pays regular shipping and handling charges on pre-paid orders.

Quantity discounts available. Ten-day money-back guarantee applies on all books.

☐ Payment enclosed ☐ Bill firm ☐ Bill me
Charge to my credit card: ☐ American Express
☐ Diners Club ☐ Visa ☐ MasterCard

Acct. No. ________________ Date Exp. ________

On MasterCard only, first numbers above name ________

Name ________
Company ________
Street ________
City ________ State ________ Zip ________
Signature ________

ELH

ElectronicsWeek

NEW PRODUCTS

# SERVER LINKS ETHERNETS WITH IBM MAINFRAMES

Any computer or terminal linked along an Ethernet can gain access to IBM mainframes in a Systems Network Architecture environment ☐ *by Steve Zollo*

A single communications server can let any computer connected to an Ethernet (assembled from the company's other network products) access IBM mainframe computers in a Systems Network Architecture. Bridge Communications Inc.'s CS/1-SNA server makes ASCII terminals or any personal computers on the Ethernet look like IBM 3278 terminals.

The cost of the server can be amortized across all networked devices because the CS/1-SNA's protocol-conversion service is fully distributed over the network, through a port-contention mechanism that works much like the access mechanism in a private branch exchange. According to Bridge's president, William Carrico, the CS/1-SNA eliminates the need for a separate protocol converter or for multiple terminals on the user's desk, making a single generic terminal or personal computer fit virtually all data processing environments. "The CS/1-SNA can be viewed as a high-performance protocol converter [and a] server distributed over the local net and accessible by all networked devices," the firm's head says.

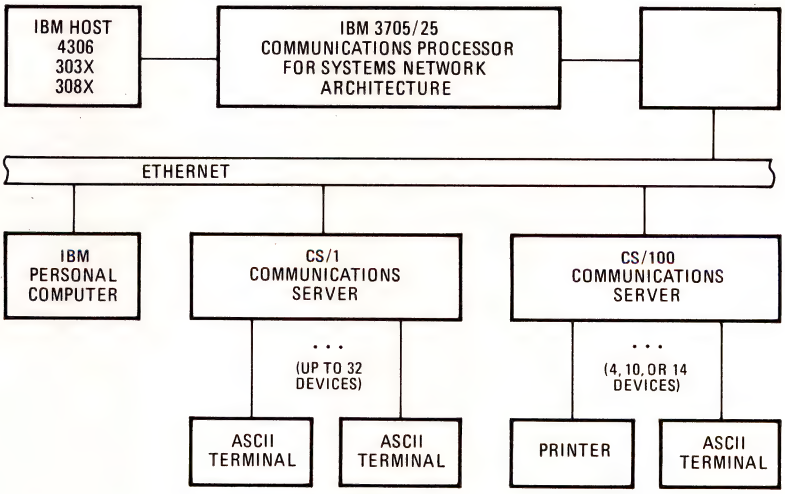
For example, "a VT100 terminal or any ASCII terminal connected to a Bridge CS/1 server may request connection over the network to any of 24 virtual ports on the CS/1-SNA. The CS/1-SNA, which to the IBM host looks like a 3274 communications controller, then establishes connection to that host and provides full 3278 screen and keyboard emulation to either the ASCII terminal or the VT100."

The emulation function includes a 25th status line and program function-key mapping to the ASCII terminal keyboard. Using a simple command, the VT100 user can switch from the IBM to another host on the network, such as a Digital Equipment or Data General minicomputer.

The CS/1-SNA also becomes a microsystem-to-mainframe link when used with IBM Personal Computers or PC-compatibles equipped with the EtherLink network interface card from 3Com Corp. 3Com's recently-announced EtherTerm software, designed for compatibility with Bridge network servers, lets PCs access the CS/1-SNA emulation services and thus become 3278 lookalikes as well.

Each CS/1-SNA can handle up to 24 ASCII terminal devices. Terminals supported include the DEC VT100, Televideo model 925, and IBM 3101, at speeds of up to 19.2 kb/s. The unit also supports emulation of IBM 3287 printers. Access to X.25 networks through Bridge's GS/1 Ethernet-to-X.25 gateway is also possible.

The port contention mechanism, which is completely transparent to the user, lets multiple devices economically share the CS/1-SNA's available ports, instead of hardwiring each user to a specific port. In a mixed environment of ASCII terminals or printers connected to the Ethernet through a Bridge server and EtherLink-



**Conversant.** Bridge Communications Inc.'s CS/1-SNA server provides protocol conversion so that any computer on its Ethernet implementation can access IBM mainframes.

equipped PCs, all can contend for CS/1-SNA ports. Multiple open sessions are possible for devices connected to Bridge communicaitons servers, permitting a user to toggle back and forth at will.

The company claims that the CS/1-SNA gives each device access to network resources and benefits that protocol converters alone could not do. These include, for example, password protection to any of the CS/1-SNA's ports, call queuing, rotoring through to a free port, multiple outstanding sessions to different SNA sessions on the host, logical naming of resources, and network management statistics and error reports.

The CS/1-SNA consists of three modules, each containing a 68000 microprocessor to maximize system performance. The main module provides Xerox Network Systems (XNS) and SNA protocol processing and emulation software. An Ethernet module interfaces the CS/1-SNA to a standard Ethernet or IEEE-802.3 network. The CS/1-SNA is connected to an IBM 3705 front-end processor and communicates at speeds up to 56 kb/s through a single Synchronous Data Link Control serial communication link, which runs on a third module.

Available 60 days after ordering, the CS/1-SNA is priced at $13,000 per unit plus a $1,000 annual software fee, which covers all updates and maintenance.

Bridge Communications Inc., 1345 Shorebird Way, Mountain View, Calif. 94043. Phone (415) 969-4400
[Circle reader service number 338]

## Converter family includes fast parts, power misers

**A trio of** flash analog-to-digital converters use a proprietary bulk silicon molybdenum-gate complementary-MOS process for high speed and low power consumption. The 6-bit MP7682, the fastest of the three chips, is a pin-compatible replacement for RCA's CA3300. It operates at 30 MHz, with linearities to within ±¼ least significant bit. With a ±½ LSB accuracy rating, it sells for $34 each in lots of 100.

The 8-bit MP7683 is the trio's power miser, consuming just 75 mW. A two-step converter, it has a 10-MHz sampling rate. In quantities of 100, the converter sells for $60 each with a ±½ LSB accuracy rating.

The 8-bit MP7684 has a parallel architecture, operates from a single 5-V supply, and uses a 1-V reference. At a 20-MHz sampling rate, the converter offers ±½ LSB accuracy and consumes 250 mW. Delivery of any of the parts takes four weeks. The company promises to make available a 9-bit flash converter, model MP8584, in the first quarter of next year.

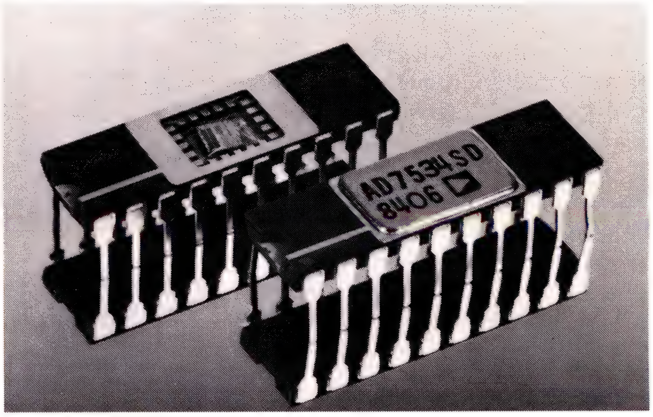
Micro Power Systems Inc., 3100 Alfred St., Santa Clara, Calif. 95050. Phone (408) 727-5350 [Circle 344]

## Analog-to-digital converter has leakage current of 5 nA

**Using a patent-pending** proprietary technique that reduces leakage current over temperature to only 1/10th that of competing chips, a monolithic 14-bit analog-to-digital converter guarantees monotonocity over the entire military temperature range. Offered in a 20-pin dual in-line package, the AD7534 provides a double-buffered microprocessor interface for loading in an 8+6 right-justified format.

The AD7534 comes in grades for use over three operating temperature ranges: grades J and K for 0° to +70°C, A and B for –25° to +85°C, and S and T for –55° to +125°C. It also guarantees maximum differential nonlinearity of ±½ least significant bit over each grade's respective temperature range as well as maximum full-scale gain error of ±4 LSB for K, B, and T, and ±8 LSB for J, A, and S.

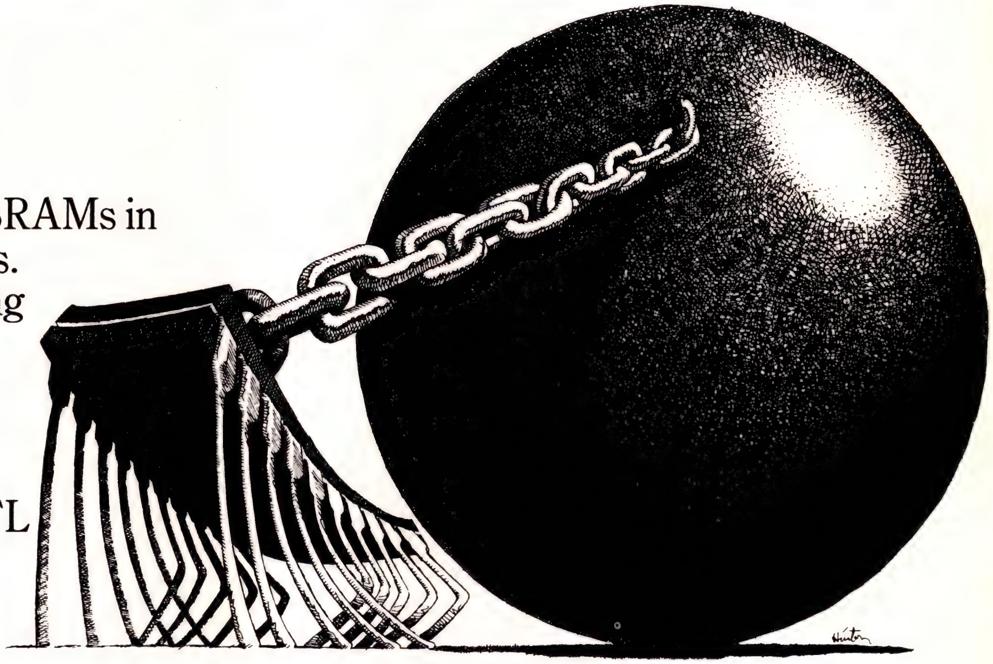
The converter's maximum leakage current is specified at 5 nA at +25°C; for operation over temperature extremes, the AD7534 limits leakage current to a maximum of 10 nA from 0° to +70°C and 20 nA from –55° to +125°C. Compatible d-a converters offer similar performance at +25°C but exhibit 10 times greater leakage than the AD7534 at +125°C, the company claims.



The AD7534, which operates with a +12-V-to-+15-V and a –0.3-V power supply, dissipates a maximum of 36 mW and provides TTL and 5-V complementary-MOS logic compatibility along with full four-quadrant multiplication. Its 14-bit resolution provides an 84-dB dynamic range for use in digital reconstruction of audio signals.

Available from stock, for immediate delivery, it is

# How to make our memories more like theirs.



Zoom!

Now you can access SRAMs in as little as 15 nanoseconds.

Because we're building them with a new super-fast CMOS based on 1.2 micron technology.

For scratch pad or cache memory, or any TTL design where high speed and reliability are critical, we're the difference between fast—and fast asleep.

While our semiconductor can outrace a bipolar, it still gives you all the efficiency you'd expect from CMOS. So you can work in the fast track without dimming the hall lights.

At a mere 1.2 microns, you keep your cool, pack your system tighter, and build it smaller. And improve your reliability.

Our high performance SRAMs, configured 256 x 4, 16 x 4, and 1K x 4, are ready right now. 4K x 1 and 2K x 8 are on the way.

They (like all our products) are made in the U.S.A. on fully automated assembly lines. So you always get high quality and you always get it on time.

Which is just what you might expect from the company that put SRAMs on the fast track.

For more information, please call (408) 943-2668. We'll show you some real good times.

CYPRESS
SEMICONDUCTOR
CORPORATION

*The best time you can have with CMOS.*

priced from $16.95 to $103.05 in quantities of 100.

Analog Devices Inc., Rte. 1 Industrial Park,
P.O. Box 280, Norwood, Mass. 02062.
Phone (617) 329-4700 [Circle 343]

## Computer with Winchester sells for under $2,000

**Breaking the $2,000** price barrier for a computer with a hard disk drive, the MD5-E is bundled with the NewWord word processing software package and Correct-It spelling checker. The MD5-E provides 5.4 megabytes of formatted hard disk storage using a 5¼-in. Winchester disk drive and 384-K bytes of storage on a double-sided double-density 5¼-in. disk drive.

The system can be expanded by adding one hard disk drive or one floppy disk drive, or both. Included with the MD5-E are the CP/M operating system, a detachable keyboard, and a terminal displaying 24 lines by 80 characters.

Based on a Z80A microprocessor running at 4 MHz, the MD5-E has 128-K bytes of random-access memory, 8-K bytes of read-only memory, three serial ports, and a parallel port. The computer is available now.

Morrow Inc., 600 McCormick St., San Leandro, Calif. 94577.
Phone (415) 430-1970 [Circle 353]

## IBM PC-compatibles offer MS-DOS in foreign languages

**A computer and** display terminal maker, Applied Digital Data Systems Inc., has unveiled two IBM Personal Computer-compatible systems, the PC/I and PC/II. The PC/I, with 256-K bytes of memory, dual floppy-disk drives, and keyboard, sells for $2,445—$2,650 with a monitor. The PC/II, which has a 10-megabyte Winchester disk drive in place of one of the PC/I's floppy disk drives, sells for $4,200 with a monitor or $3,995 without.

The computer's 12-in. screen has a resolution of 600 by 200 pixels, displaying either 25 lines of 40 characters or 25 lines of 80 characters. Standard features of 8088-based systems include a video output for monochrome, composite color, red-green-blue, light pen, and radio-frequency modulator interfaces; serial and parallel printer ports; an 8087 coprocessor; and five expansion slots for adding peripherals.

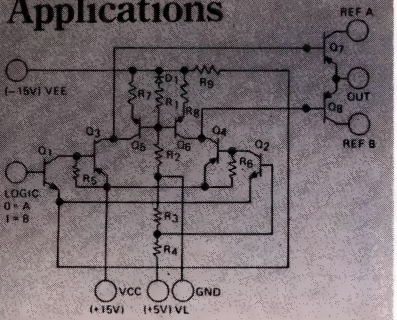
The company also offers a selection of foreign language versions of its MS-DOS operating system. Systems are available now.

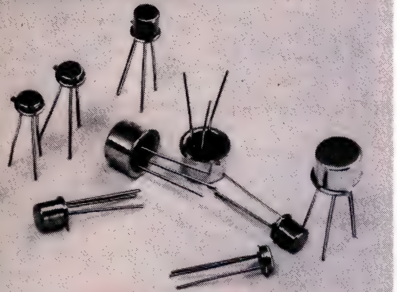
Applied Digital Data Systems Inc., 100 Marcus Blvd., Hauppauge, N.Y. 11788.
Phone (516) 231-5400 [Circle 346]

## Unix-based business system costs under $2,000 per user

**An entry- level** multiuser Unix-based 32-bit microcomputer system for business accounting, word processing, and similar data processing applications will cost about $2,500 per user. Based on the 68000 microprocessor, the MicroFactor is a 43-megabyte shared-resource four-user system that sells for about 50% less than networked personal computers, the firm says.

MicroFactor's architecture is built around the VMEbus. Its Unix System III operating system supports such languages as C, Cobol, Fortran, Pascal, and Basic. The system includes 512-K bytes of random-access memory, one 43-megabyte 5¼-in.





Selected Applications

Select Devices

Bipolar Transistors
Aerospace
Military
Medical

Crystalonics developed the epitaxial junction process for chopper and switching transistors and continues to be the leader in the technology. Our line includes:

- NPN Low Level Switching and Chopper Transistors: BVEBO to 30V, $r_{ec}$ (sat) to 2 Ohms and $H_{fe}$ (inv) to 30 (2N6566); $V_O$ to 0.4 mV (2N2432A).
- PNP Low Level Switching and Chopper Transistors: BVEBO to 50V (2N5231), $H_{fe}$ (inv) to 50 and $V_O$ to 0.3 mV (2N2944A); $r_{ec}$ (sat) to 2 Ohms (2N6567).
- Dual Emitter Choppers, NPN and PNP: BVEEO to 50V, $V_O$ to 30 $\mu$V, and $r_{ee}$ (sat) to 15 Ohms.
- Complementary Ultra-Low $r_{ec}$ (sat) PNP/NPN Switches: BVEBO 30V, $V_O$ 1 mV, and $r_{ec}$ (sat) to 2 Ohms.
- JAN/JANTX/JANTXV Transistors: qualified on over 20 types, including the popular series 2N2432 and 2N2946.
- NPN Grown Junction Replacements, including JAN2N333 thru 2N343.

For further information send for our short form catalog.

TELEDYNE
CRYSTALONICS

147 Sherman Street
Cambridge, MA 02140
Tel: (617) 491-1670
TWX 710-320-1196

Circle 80 on reader service card

# TEAC Floppy Disk Drives —A Wide Selection

TEAC's mini and compact floppy disk drives offer you a wide choice of size, data capacity, and disk formats. But with all these options, there's one thing you won't have to compromise on. Excellence—a built-in feature that can't be reduced.

The FD-55 5-1/4" mini floppy series offers six models to choose from: A, B, E, F, G, and GF, ranging in data capacity from 125 kbytes to 1.6 Mbytes. New TEAC LSI's reduce both power consumption and the need for IC's. And the FD-55's pack this speed and power into a casing that is half the height of most conventional disk drives.

If a compact 3" drive is what you're looking for, TEAC will fit it in the palm of your hand. The FD-30A compact floppy disk drive weighs only 1-1/2 lbs. (750 g). It can do the work alone or together with the FD-55's. They are compatible in every way—capacity, format, disk rotation speed, transfer rate and connections.

Our FD-35 3-1/2" micro floppy disk drive series is an extension of this excellence. Four models offer 125 kbytes to 1 full, roomy megabyte of data storage and super fast access time. Drawing on TEAC's long experience in disk drive development, each model features a brushless spindle motor, advanced TEAC LSI's, and high precision head positioning. What's more, each is available in a PS (Power Save) version with a typical power consumption of 1.72 W during operation and 27 mW max. during standby. All models are compatible with most standard 5-1/4" units through TEAC's FC-55 disk controller.

TEAC's wide range of disk drives offers you options in excellence without making excellence an option.

Floppy disks with this mark can be used with the FD-30A.

## FD-35A

- Single sided
- Track density: 67.5 tpi
- Data capacity: 250 kbytes

## FD-35B

- Double sided
- Track density: 67.5 tpi
- Data capacity: 500 kbytes

## FD-35E

- Single sided
- Track density: 135 tpi
- Data capacity: 500 kbytes

## FD-35F

- Double sided
- Track density: 135 tpi
- Data capacity: 1Mbyte

**TEAC**

**TEAC CORPORATION: 3-7-3 Naka-cho, Musashino, Tokyo, Japan Tel: (0422) 53-1111**

■**U.S.A.** TEAC Corporation of America, Tel: (213) 726-0303 ■**New Zealand** McLean Information Technology Ltd., Tel: 501-801 ■**Australia** Electrical Equipment Ltd., Tel: 597 1155 ■**Hong Kong** Nissei Sangyo Co., Ltd., Tel: 3-343441-6 ■**Singapore** Nissei Sangyo (S) Pte. Ltd., Tel: 7372011 ■**South Africa** SPESCOM (PTY) LTD., Tel: 836-9181 ■**United Kingdom** Tekdata Limited, Tel: 0782 813631 ■**West Germany** nbn Electronik GmbH., Tel: 08152/390 ■**Holland** Simac Electronics B.V., Tel: 040-533725 ■**Belgium & Luxemburg** Simac Electronics S.P.R.L., Tel: 02-219.24.53 ■**France** Tekelec Airtronic S.A., Tel: (1) 534-75-35 ■**Italy** A.E.S.S.E.s.p.a. Tel: 54.64.741-2-3 ■**Spain** Ataio Ingenieros S.A., Tel: 733 0562, 733 3700 ■**Switzerland** Wenger Datentechnik, Tel: 061/76 87 87 ■**Denmark** Dansk Binær Teknik A/S, Tel: 03-662020 ■**Sweden** Scantele AB, Tel: 446-08-24 58 25 ■**Norway** Scantele AS, Tel: (47-2) 67 21 30 ■**Finland** INSTRUMENTARIUM ELEKTRONIKKA, Tel: (90) 505-2255

** If no distributor is listed above in your area, please contact us directly for further details about our products.*

Circle 104 on reader service card

ORDER TODAY!

# EASY, RELIABLE SOLUTIONS TO YOUR DESIGN PROBLEMS

## Design Engineers; Technicians; Supervisors; This book is for YOU!

**CIRCUITS AND SOFTWARE FOR ELECTRONICS ENGINEERS** can save you development time and money by giving access to stimulating, clever approaches that speed creative design concepts.

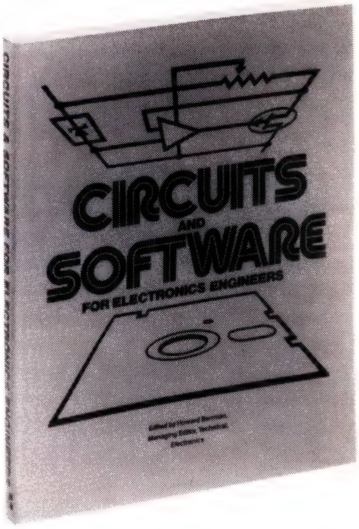
**CIRCUITS AND SOFTWARE FOR ELECTRONICS ENGINEERS** covers a vast array of design problems conveniently organized into 25 vital categories by function, including:

> amplifiers, control circuits, instrument circuits, microprocessors and power supplies, plus software for computers and calculators.

**CIRCUITS AND SOFTWARE FOR ELECTRONICS ENGINEERS** contains hundreds of circuit schematics, block diagrams, waveforms and computer programs that have been proven to work and meet the highest standards of performance.

You'll find valuable and reliable information on a variety of design problems including:

- exploiting the full potential of an rf power transistor
- interfacing a 10-bit a-d converter with a 16-bit microprocessor
- operating instrumentation-meter drivers on a 2-V supply
- interfacing opto-isolated RS-232 to achieve high data rates
- enabling a processor to interact with peripherals using DMA
- a programmable source sets the voltage of E-PROMs
- a TI-59 program tracks satellites in elliptical orbits
- an interface program that links a-d chip with microprocessors



Edited by Howard Bierman,
Managing Editor, Technical—
*ELECTRONICS* Magazine

**These creative, new ideas and approaches keep you on top of what's happening in the latest circuitry developments.**

Focused strictly on design problems, **CIRCUITS AND SOFTWARE FOR ELECTRONICS ENGINEERS** delivers professional, innovative solutions for your most demanding projects.

This volume is essential to

- design appropriate circuitry to meet the most challenging specifications
- cut design time by adapting proven circuits and software to a wide range of applications
- save money and increase productivity by avoiding costly design errors.

So whether you are a design engineer, technician or supervisor—don't take the chance of being less than on top of the latest circuitry developments!

**Before you tackle your next project, order this valuable resource today!**

Use the coupon or send in your company purchase order.

**McGraw-Hill Int'l. Publications Co.**
Attn: ECC
McGraw-Hill House
Maidenhead, Berkshire SL6 2QL
England
(Tel. (0628) 23431; Telex 848640)

Send me ________ copy (copies) of CIRCUITS AND SOFTWARE FOR ELECTRONICS ENGINEERS for $19.95 each. U.S. residents please include local sales tax.

☐ Payment enclosed (postage & handling included)
☐ Bill me (postage, handling & tax will be added) NOTE: All orders under $25 will be sent a pro-forma invoice requiring prepayment.
☐ Bill my company. Purchase order is attached.

Ship to:

Name ______________________________

Company ______________________________

Street Address ______________________________

City ______________ State ______________ Zip ______________

Country ______________________________

Please allow four to six weeks for delivery.
McGraw-Hill knows you will be satisfied, but if for some reason you're not, there is a ten-day money-back guarantee that applies on all books.

# Enter the new era of
# MICROSYSTEM DESIGN

**MICROPROCESSOR SYSTEMS: Software and Hardware Architecture** delivers a wealth of information about microcomputers, peripherals, networks, signal processing and software, that leads the field in the 80's!

This book is a comprehensive collection of technical articles, carefully detailed and presented, in exclusive reprints from *Electronics* Magazine.

Corporate Managers, Project Managers, Design Engineers, Market Managers: **MICROPROCESSOR SYSTEMS: Software and Hardware Architecture** is one book for all!

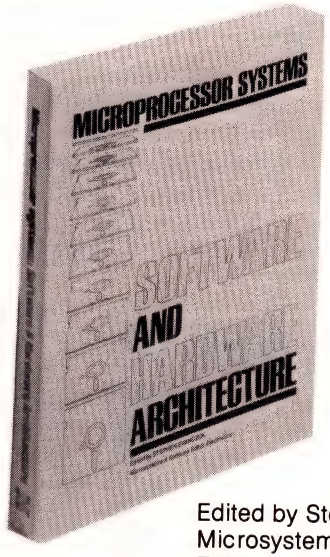
Six knowledgeable chapters examine:

- Significant trends in the development of new software systems and applications
- Technical articles on the manufacture of new microprocessors
- Approaches to memory management used by major chip manufacturers
- Conveniences of peripheral chips
- Alternative network methods from Ethernet to token-passing protocols
- Modular procedures for making digital signal processing systems

Engineers - Save precious time by eliminating a cumbersome series of software instructions.

Directed chiefly at design tactics, **MICROPROCESSOR SYSTEMS: Software and Hardware Architecture** helps you avoid errors and overcome all your architectural problems.

- Brings you the needed simplicity of design, without sacrificing performance of the finished system
- Offers a means of tapping microsystems into the power of mainframe machines
- Recounts major breakthrough in dedicated chips that handle math operations in record time



Edited by Stephen Evanczuk,
Microsystems & Software
Editor, *ELECTRONICS*

In one resourceful volume, **MICROPROCESSOR SYSTEMS: Software and Hardware Architecture** lets you understand:

- Functions of hour end microprocessors and controllers
- Key microprocessors that trigger the personal computer revolution
- The importance of dedicated chips more sophisticated than mainframes of yesteryear
- Significant aspects of microcomputer software
- Efficiency of peripheral-control chips

Here it is -
**MICROPROCESSOR SYSTEMS: Software and Hardware Architecture** - Let it design for you!

Don't be left in the dark: **MICROPROCESSOR SYSTEMS: Software and Hardware Architecture** illuminates the design process of an ever changing industry.

**Don't delay -- order your copy today!**

Use the coupon or send in your company purchase order.

**MC GRAW-HILL PUBLICATIONS CO.**
Attn: ECC
McGraw-Hill House
Maidenhead, Berkshire SL6 2QL
England
(Tel. (0628) 23431; Telex 848640)

Send me ________copy(ies) of MICROPROCESSOR SYSTEMS: Software and Hardware Architecture for $21.95 each. (U.S. residents please include local sales tax).

☐ Payment enclosed (postage & handling included)
☐ Bill me (postage, handling & tax will be added) NOTE: All orders under $30 will be sent a pro forma invoice requiring prepayment.
☐ Bill my company. Purchase order is attached.

Ship to:

Name ________________________

Company ________________________

Street Address ________________________

City__________State________Zip________

Country ________________________

McGraw-Hill knows you will be satisfied, but if for some reason you are not, there is a ten-day money-back guarantee that applies on all books. Allow four to six weeks for delivery.

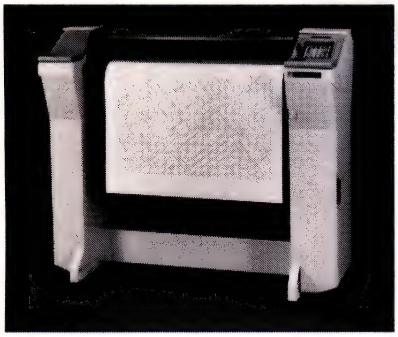
Winchester disk drive, four RS-232-C ports, one parallel port, and a choice of either a 5¼-in. floppy disk or a 32-megabyte streaming tape drive for backup. Now in stock, the floppy-disk version sells for $9,990 and the streaming-tape-drive version for $11,990.

Victory Computer Systems, 1610 Berryessa Rd., San Jose, Calif. 95133. Phone (408) 259-7370 [Circle 345]

## Eight-pen plotters can handle ANSI size E paper

**A line of pen plotters** features eight pens and full-width plotting that can handle ANSI size E or International Organization for Standardization size AO. It sells for about half the price of comparable models. Model 1043 performs in the cut-sheet mode only, while the model 1042 operates in both cut-sheet and roll-feed modes.

With an acceleration of 0.5 g, model 1042 features a plotting speed of 6 in./s. Model 1043's acceleration is 1.0 g, its plotting speed 14 in./s. The user can mix up to eight different colors or pen types in one turret, including liquid ball point, nylon tip, Ceramicon, and liquid ink pens. The bar-coded pen type is sensed by the mechanism and the appropriate pen height, force, and velocity are automatically adjusted for each pen type to ensure quality and high throughput.



Features of the line include an eight-pen turret with automatic pen capping, an integrated communications interface, nonvolatile setup memory, and diagnostics.

Both models are priced at $8,495. The model 1043 will be available in October, the 1042 in November.

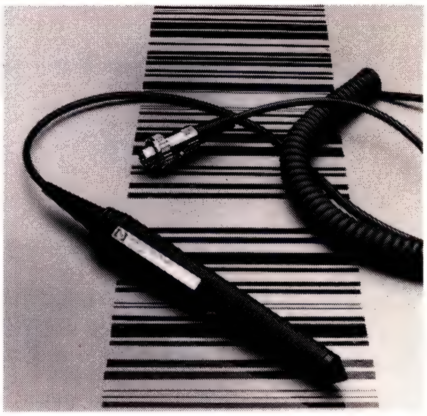
Calcomp, 2411 West LaPalma Ave., Anaheim, Calif. 92801. Phone (714) 821-2142 [Circle 379]

## Bar-code decoder IC reads, switches from code to code

**A bar-code decoder** integrated circuit and sapphire-tip digital wand product set will eliminate the need for bar-code software development. Aimed at manufacturers of data collection, cathode-ray-tube and point-of-sale terminals, personal computers, keyboards, and other data-collection equipment, the set offers a choice of rugged metal-case wands.

The standard decoding IC supports four of the most used codes—3-of-9, Extended 3-of-9, Interleaved 2-of-5, and Universal Product Codes—as well as others. If more than one standard code is enabled, the reader automatically will recognize the code being scanned.

Both parallel and serial ASCII interfaces are available, so the IC is easy to use with most common microprocessors. It performs the functions of a typical decoding box, thereby eliminating that piece of equipment.



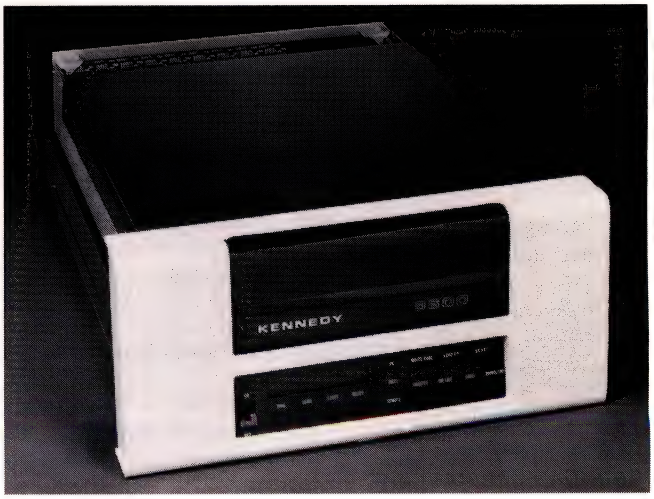
The HBCS-4300 wand incorporates an optical sensor with a 700-nm visible red light-emitting diode; and the HBCS-4500 wand contains an 820-nm infrared LED. Both wands have a photo IC detector and precision aspheric optics. The internal signal-conditioning circuitry converts the optical information into a logic level pulse-width representation of bars and spaces.

The 4300, with its nominal 0.19-mm spot size, is designed for reading a general range of bar codes, while the 4500 has a nominal spot size of 0.13 nm and reads high-density bar codes.

In quantities of 25 to 99, the HBCR-1000 decoder IC and wand product set sells for $245 each.

Hewlett-Packard Co., Inquiries Manager, 1820 Embarcadero Rd., Palo Alto, Calif. 94303 [Circle 385]

## Auto-loading tape transport does start/stop, streaming



**Among features offered** by magnetic tape transports—both conventional start/stop and streaming types—automatic loading has quickly emerged from a somewhat useful option to a can't-do-without status. Getting this message from customers, Kennedy Co. has gone to lengths to ensure that its new Model 9600 has the most mistake-proof automatic tape threading possible.

Under dedicated microprocessor control, the transport has seven photo-transistor sensors that note the tape location at every point throughout its path. All an operator has to do is slip any size reel into the slot, close the

# ElectronicsWeek is important to him... I'm sure it's important to me.

Ever notice how some people always seem to have the right answer? No matter what the situation, they always seem to be a step ahead.

And they're successful ... the first in line to lead an important project...the first in line for a promotion. It's certainly not magic. Usually it's a combination of hard work, brains, guts and desire.

It probably means they read ElectronicsWeek... regularly.

ElectronicsWeek has helped propel many a manager and engineer to the front line... to the "leading edge" of the industry. And just as we've been providing many of your colleagues with the right information, the important information—when they need it most—so too can we provide it for you.

Every week an ElectronicsWeek subscriber receives an issue crammed with the latest information on new products, developments, concerns and trends in the worldwide electronics industry.

When you become a subscriber, we'll supply you with the intelligence you need to make the big decision, or the every day decision to further your career and reap profits for your company. For a taste, just browse through the issue you're holding.

But, you really don't have to believe us. Just ask the person who's always a step ahead.

To become a subscriber, just complete and mail the insert card in this magazine. If subscription card is missing, write: Circulation Manager, ElectronicsWeek, P.O. Box 511, Hightstown, N.J. 08520.

Mc
Graw
Hill

**ElectronicsWeek**

**The Voice of the industry**

door, and wait. From the sensor data, the microprocessor adjusts an internal air flow to guide the threading. By comparison, previous auto-thread transports, including Kennedy's own, often mangled the tape along the path, the company says. An eight-digit light-emitting diode array displays malfunctions and instructions in English for the operator.

The transport, for example, is a true start/stop unit, with tension arm and capstan motor, operating at 45 in./s for file-management jobs. It can also be a streaming transport, at 100 in./s for disk-drive backup. The model 9600 uses ½-in. reel-to-reel tape contained in a standard 10½-in. reel. The combination streaming and start/stop unit has nine-track read-after-write capability employing 1,600-characters/in. data density, using phase-encoding techniques. The transport operates in start/stop mode at 800 c/in. in the non-return-to-zero inverted (NRZI) mode. Data transfer rate is 160 kb/s in the phase encoding and 80 kb/s in NRZI. Start/stop time is 8.3 ms at 45 in./s with a 0.6 in. interrecord gap. Its rewind speed is 200 in./s.

In the streaming mode, high-precision 1,000-line optical tachometers give constant speed (±5%) as well as indicate tape position. Read and write access time is 100 ms. Reposition time from a full stop is 650 ms.

Instead of potentiometers, Model 9600 has erasable programmable read-only memories that hold values for channel-dependent parameters such as skew, gain, and threshold. They also contain ramp and speed values for overall transport control. Technicians access the appropriate memory location, then erase and reprogram the correct adjustment in minutes. The multiple processors not only provide control but give extensive diagnostics. An inital power-on check steps through all functions and continues to monitor the transport while in operation.

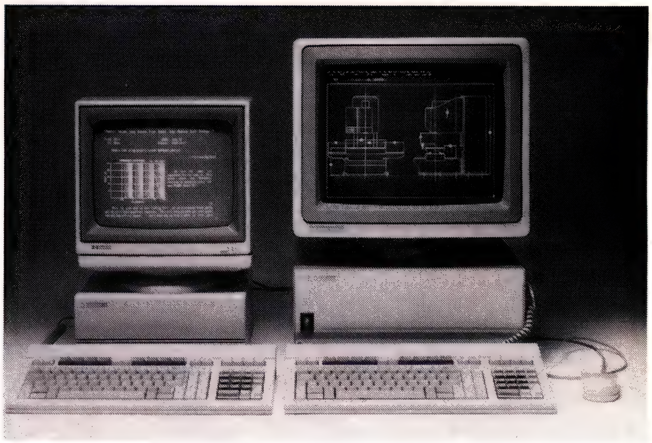
Delivery of evaluation units is quoted at 90 days, with production set for October. The price will be $3,400 in quantity.

Kennedy Co., 1600 Shamrock Ave., Monrovia, Calif. 91016.
Phone (818) 357-8831 [Circle 384]

## Additions to work-station line target graphics, engineering

**Two low-cost models** have been added to the HP 9000 series 200 line of 68000-based computers. The model 217 engineering work station is a modular computer using the 68000 microprocessor with memory management and an 8-MHz clock. It features a 14-in. green-phosphor monitor with 512-by-390-pixel resolution and 512-K bytes of random-access memory, expandable to 4 megabytes using a 1-megabyte RAM board.

The model 237, which is targeted at graphics applications, has a 68000 processor running at 12.5 MHz with memory management and cache memory. It features a 17-in. monitor with a 1,024-by-768 pixel bit-mapped display and 512-K bytes of RAM expandable to 7 megabytes.



Available for use with either model is a floating-point math processor and new versions of Basic and Pascal compilers. The model 217 is priced at $6,510 and the 237 at $14,500. The mouse goes for $148. The 1-megabyte RAM board sells for $4,180, the math processor for $975, and the Basic and Pascal compilers for $860 and $995, respectively.

All the products are available 8 to 12 weeks after receipt of order.

Hewlett-Packard Co., Inquiries Manager, 1820 Embarcadero Rd., Palo Alto, Calif. 94393 [Circle 347]

## Chip set handles scrolling and split screens for CRTs

**An n-channel MOS** and a bipolar chip team up to provide a raster-scan cathode-ray-tube controller that handles multiple windows and soft scrolling in hardware. Advanced Micro Devices Inc.'s NMOS Am8052 CRT controller and the bipolar Am8152 video system controller combination also support proportional spacing, text justification, and double-width characters.

Up to now, both soft scrolling and multiple windows have been done in software, consuming a lot of memory. "This chip set does both horizontal and vertical windows—any number of them," says Dick Koeltl, product marketing manager.

A direct-memory-access controller and three row buffers on the Am8052, each 132 characters by 20 bits, support the soft-scroll and multiple-windows features. The on-chip DMA controller accesses the display memory and loads data from linked-list data blocks in memory into one of the row buffers. Each 20-bit-wide location accommodates an 8-bit character code and 12-bit attribute words. The row buffers operate in a rotating fill-display mode, in which one buffer is loaded while another is being displayed.

The presence of the three row buffers on chip enables split-screen soft-scrolling operations where a character row may only be displayed for a single scan line. Two buffers would not leave enough time for the reloading of the alternate line buffer. A partially filled buffer results in screen flashing or flickering. This can only be prevented by the three row buffers, the company maintains.

The DMA channel on the Am8052 operates through linked-list structures that allow for the overlaying and

# Circuits.
# Circuits.
# Circuits!

### Electronic Circuits Notebook. 344 pp., illus.

Some 268 proved-in-action circuits are gathered here for the first time in a single, easy-access resource that meets the highest standards of performance, cost reduction, and reliability. From amplifiers to voltage regulators . . . from data conversion to phase lock loops . . . you'll find the most needed, most reliable solutions to a vast range of circuitry challenges.

### Circuits for Electronics Engineers. 396 pp., illus.

More than 340 circuits from all over the world are arranged here by 51 of the most important functions designers use to implement their systems, including amplifers, detectors, memory circuits, integrators, and much more. Complete with component values, circuit diagrams, waveshapes where applicable, and clear explanations of operations and applications.

### Design Techniques for Electronics Engineers. 370 pp., illus.

The best of *Electronics'* popular "Engineer's Notebook," this is an indispensable storehouse of solutions to numerous frequently encountered design problems. You'll find a host of proven techniques to help you make measurements, interpret data, make calculations, choose materials, control environment, lay out and purchase components, and more!

**Electronics Week Books**
McGraw-Hill Inc. Princeton Road
Hightstown, N.J. 08520 (Tel.) 609/426-5070

| No. of Copies | Title | Price |
|---|---|---|
| ______ | Electronic Circuits Notebook | $17.95 |
| ______ | Circuits for Electronics Engineers | $17.95 |
| ______ | Design Techniques for Electronics Engineers | $17.95 |
| ______ | Microprocessors and Microcomputers: One-chip Controllers to High-end Systems | $18.95 |
| ______ | Microelectronics Interconnection and Packaging | $15.95 |
| ______ | Practical Applications of Data Communications: A User's Guide | $17.95 |

If after my 10-day free-trial examination I am not fully satisfied I understand that my payment will be refunded. Payment must accompany orders under $25.

☐ Payment enclosed ☐ Bill firm ☐ Bill me

Charge to my credit card:
☐ American Express ☐ Diners Club
☐ Visa ☐ Master Card*

Acct. No. ______ Date Exp. ______

*On Master Card only, first numbers above name ______

Name ______ Title ______

Company ______

Street ______

City ______ State ______ Zip ______

Signature ______ ELV

Discounts of 10% on orders of more than 10 books.

---

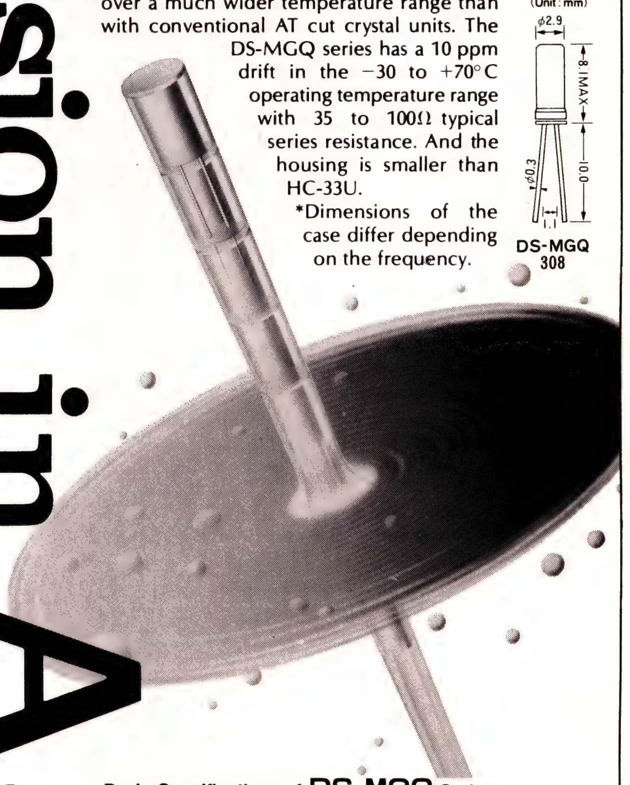
# Precision in Action

At Seiko Instruments & Electronics Ltd., our experience and expertise in precision instruments are the active factors in our development of quartz crystal units. Excellent aging, shock and vibration resistance characteristics; small size; easy mounting; superior properties for numerous applications -- Seiko I & E quartz crystal units. They put new possibilities into action.

## DS-MGQ Series

DS-MGQ series is ultra-small GT cut quartz crystal units featuring superior frequency-temperature characteristics. In fact, extremely stable frequencies are obtained over a much wider temperature range than with conventional AT cut crystal units. The DS-MGQ series has a 10 ppm drift in the −30 to +70°C operating temperature range with 35 to 100Ω typical series resistance. And the housing is smaller than HC-33U.

*Dimensions of the case differ depending on the frequency.



### Basic Specifications of DS-MGQ Series

| Item | 460 | 388 | 308 | 206 |
|---|---|---|---|---|
| Oscillation frequency (at +25°C) | 1~1.199MHz | 1.2~1.699MHz | 1.7~2.699MHz | 2.7~3.0MHz |
| | ±5, ±10, ±20, ±40, ±100ppm | | | |
| Quality factor | 300,000Typ. | 200,000Typ. | 180,000Typ. | 150,000Typ. |
| Series resistance | 35Ω Typ. | 60Ω Typ. | 80Ω Typ. | 100Ω Typ. |
| Frequency temperature characteristics (−30°C~+70°C) | ±5, ±10, ±25, ±50, ±100ppm | | | |
| Drive level | 20μW Max. | 10μW Max. | 5μW Max. | 3μW Max. |
| Aging (first year) | 1.0ppm Typ. | | | |
| Shock resistance (Dropped on a hard wood board from a height of 75cm) | ±3ppm | | | |
| Vibration resistance (Amplitude 1.5mm, 10~55Hz vibration applied in the 3 directions for 2 hours each) | ±1ppm | | | |

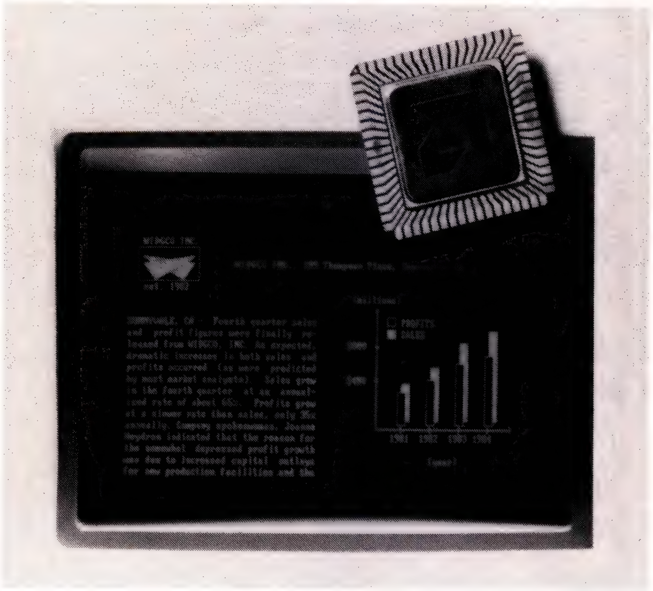
● The standard load capacitance is 10pF.

## SEIKO INSTRUMENTS & ELECTRONICS LTD.

**Components Sales Department:** 31-1, 6-chome, Kameido, Koto-ku, Tokyo 136, Japan Phone: (03)684-2010 Telex: 2622162 DSEIKO J
**Seiko Instruments GmbH:** Arabella Center 13 OG Lyoner Strasse 44-48, 6000 Frankfurt/Main 71 W. Germany Phone: 069-6666971 Telex: 413045 SIG D
**Seiko Instruments U.S.A. Inc.:** 2990 W. Lomita Blvd., Torrance Calif. 90505 Phone: 213-530-8777 Telex: 9103477307 SEIKOINST TRNC
**Precision Engineering Ltd. Sales Division:** Room 901-5, Tower A, Mandarin Plaza, 14 Science Museum Road, East Tsim Sha Tsui, Kowloon, Hong Kong Phone: 3-676485, 683160, 683169, 697593 Telex: 40211 PELSD HX

*On October 1, 1983, Daini Seikosha Co., Ltd. changed its name to Seiko Instruments & Electronics Ltd.

Circle 105 on reader service card



independent soft scrolling of windows. The linked-list data structures are particularly suited to the manipulation of data strings where insertions and deletions are common, as in word processing applications.

The linked list consists of row-control blocks for each character row on the screen. A block does not contain any displayable data; instead it contains the address that points to the character information. Each block is linked to the next block through an address link word. Addresses, rather than actual characters, are added or deleted.

The Am8052 controller is housed in a 68-pin leaded chip carrier, while the bipolar Am8152 is contained in a 48-pin dual in-line package. Available six weeks after ordering, the 5-MHz Am8052 is priced at $76.50 each in lots of 100, and the 6-MHz version sells for $92 each in like quantities. The Am8152, which has TTL-compatible outputs, sells for $32 each in 100-piece quantities. The Am8153 has emitter-coupled-logic-compatible outputs.

Advanced Micro Devices Inc., 901 Thompson Pl., P.O. Box 453, Sunnyvale, Calif. 94086.
Phone (408) 732-2400 [Circle 348]

---

## Asynchronous PAL's outputs can be individually clocked

**Radically departing** from standard programmable-array logic devices, which are geared toward synchronous circuits that are referenced to a single master clock, the PAL20RA10 circuit is a registered asynchronous device with outputs that can be individually clocked. The PAL20RA10 is suitable for discrete logic functions and random logic replacement.

The circuit is supported by a variety of programmer manufacturers as well as the company's own PALASM computer-aided design software. Unlike other devices of its type, the PAL20RA10 circuit has 10 registered asynchronous cells that can be clocked independently of each other. The device, which has 20 array inputs and 10 outputs, has an 8-mA output drive and a maximum frequency in excess of 20 MHz. In lots of 100, the circuit sells for $21.27 each and is housed in a Skinnydip skinny dual in-line package.

Monolithic Memories Inc., 2175 Mission College Blvd., Santa Clara, Calif. 95050.
Phone (408) 970-9700 [Circle 349]

---

## Switched-capacitor filter plus one chip build a modem

**A monolithic** switched-capacitor filter, the XR-2103 performs the complete filtering function necessary for a Bell standard 103 (300-baud) compatible modem. The complementary-MOS integrated circuit is intended for use with the company's XR-14412 frequency-shift-keyed modem to form a complete, inexpensive two-chip modem.

The XR-2103 contains high- and low-bandpass filters and internal mode switching. An integral auto-zeroing limiter eliminates any need for manual zeroing. An onboard, carrier-detecting device completes the circuit. The XR-2103 can operate from a 4-MHz crystal or from a 1-MHz input from the XR-14412.

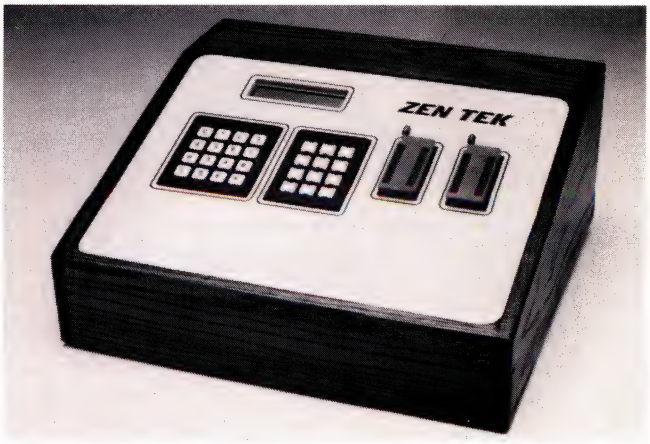
Priced at $3.75 each in lots of 25,000 pieces, the filter is available now. The XR-2103 and XR-14412 bought as a pair costs $5.75 in like quantities. Both are available for immediate delivery.

Exar Integrated Systems Inc., 750 Palomar Ave., P.O. Box 62229, Sunnyvale, Calif. 94088.
Phone (408) 732-7970 [Circle 350]

---

## Portable development system works alone, with computers

**A portable development system** priced at $5,895 works with many microprocessors and a range of programmable read-only memories. The Universal Development System (UDS), which operates on a stand-alone basis or as a peripheral to personal computers, includes two RS-232-C ports, two 60-pin device-adapter connectors, two key pads, and a 16-character liquid-crystal display.



Both configurations offer such functions as in-circuit emulation of popular PROMs affording pre-use test, debug, and alteration capability; PROM program upload and download; and PROM-to-PROM comparison with 64-K capacity. When operating as a peripheral, the system adds the ability to in-memory emulate microprocessors, PROMs, or both simultaneously. A multitude of interconnections between devices, the system, and personal computers is possible. Software for interaction between the UDS and the host is included in the base price. All of the cross-assemblers for the UDS are written in 8080 machine code for execution under CP/M80-, CP/M86-, and MS/DOS-based computers.

The UDS is available within 60 days of ordering.

Zen Tek Corp., 455 Whitepine Dr., Salt Lake City, Utah 84123. Phone (801) 263-3925 [Circle 357]

---

## Chip capacitor's values range from 1,000 pF to 0.015 µf

**A ceramic capacitor chip** measuring 0.04-in. long, 0.03-in. wide, and 0.30-in. thick is suited for micro-miniature hybrid-circuit applications. The company claims that it is the smallest multilayer ceramic capacitor available on the market today. In a package called the R09 size, it comes in three families of dielectrics, covering a range of capacitance values.

The model NPO/COG has capacitances ranging from a minimum of 0.5 to a maximum of 100 pF; the BX/X7R from 100 to 2,200 pF; and the Z5U/Y5V from 1,000 pF to 0.015 µF. Prices range from 77¢ to $2.40 each in 1,000-piece orders with deliveries from stock.

Johanson Dielectrics Inc., 2220 Screenland Dr., Burbank, Calif. 91505.
Phone (213) 848-4465 [Circle 354]

---

## Op amp powers motors needing up to 10 A of drive

**An operational amplifier** is designed for applications requiring up to 10 A of drive to resistive, capacitive, or inductive loads. The PA51M's class C output stage configured with monolithic darlington transistors makes it rugged and able to hold quiescent power dissipation to a minimum. Intended for powering motors, actuators, coils or heaters, the

KENTRONIX

DDY870A/B
CHARACTER DISPLAY TERMINAL
DEC® VT100/VT131 COMPATIBLE
LOCAL EDITING FUNCTION AVAILABLE
ADJUSTABLE TILT/SWIVEL & LOW-PROFILE KEYBOARD

DDY870A/B Character Display Terminal has ANSI standard control functions and emulates DEC® VT100/VT131 functions. Advanced techniques, such as 132 characters or 80 characters × 24 lines, smooth-scroll, etc. are fully employed, furthermore angle adjustment of the display system (tilt/swivel) and low-profile keyboard conforming to DIN standard are adopted.

KENTRONIX Kentronix, Inc.
No. 2 Nichidai Bldg. 1-6-14, Higashi-Nakajima, Higashi-Yodogawa-ku, Osaka 533, Japan
Phone: 81-6-323-1707 Telex: J64531 KENTRONX Fax: 81-6-323-1762
Please contact Kentronix for your nearest distributor

Circle 89 on reader service card

IRON POWDER CORES
FOR RF APPLICATIONS, POWER CHOKES, EMI/RFI FILTERS

MICROMETALS
IRON POWDER CORES

1190 N. Hawk Circle, Anaheim, California 92807 USA • (714) 630-7420 • TWX 910-591-1690

Circle 106 on reader service card

PA51M suits dual supplies up to ±40 V over the military temperature range. In a hermetically sealed, eight-pin TO-3 package, the amplifier features a monolithic bipolar input stage and internal compensation for use at all gain settings.

The integrated circuits use thick-film conductors, ceramic capacitors, and silicon semiconductors, and have been screened to meet revision C of MIL-STD-883. Ultrasonically bonded aluminum wires provide reliable interconnections at all operating temperatures.

In lots of 100 pieces, the PA51 sells for $37.95 and the PA51M, the military version, for $78.50 each. Delivery of the standard part takes four to six weeks, the military part up to 16 weeks.

Apex Microtechnology Corp., 1130 East Pennsylvania St., Tucson, Ariz. 85714.
Phone (602) 624-0273 [Circle 355]

## Unit tests access times of memories, buffers

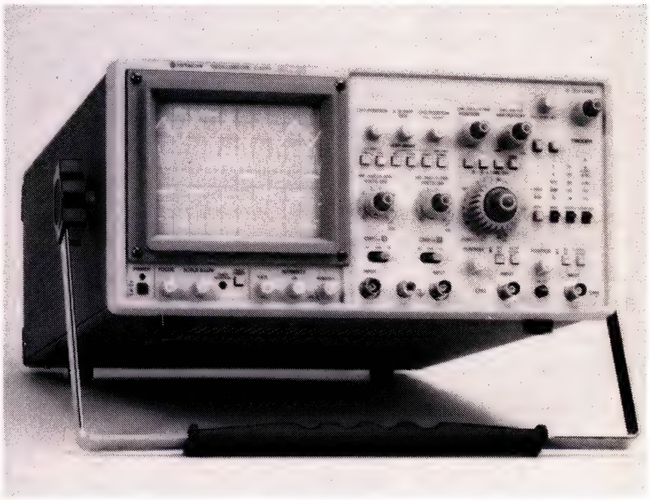
**An instrument tests** access times of read-only memories and programmable ROMs, static random-access memories and buffers, and propagation times of programmable logic arrays, gates, and cables. The unit features a resolution to within 1 ns over its range of 0 to 390 ns, and absolute accuracy is ±2 ns from 0 to 60 ns and ±5 ns from 61 to 390 ns.

The model AT700, which comes with an alphanumeric liquid-crystal display, is suitable for use in incoming inspection to verify device specifications, in the laboratory to select or grade devices, and in production tests to measure device degradation caused by voltage, current, heat, or other conditions. For high-volume testing applications, a handler interface is available. A plug-in module is used to calibrate the system before use.

The lightweight, portable model AT700 is priced at $2,850, and is available in 30 days. An optional RS-232-C interface priced at $350 is available for use with automatic test equipment or a host computer.

Hilevel Technology Inc., Irvine Technology Center, 18902 Bardeen Way, Irvine, Calif. 92715.
Phone (714) 752-5215 [Circle 365]

## Portable 100-MHz scope has built-in voltmeter



**The model V-1070** is a low-cost version of the model V-1100 intelligent 100-MHz portable oscilloscope. It includes a built-in frequency counter and digital voltmeter, cathode ray terminal readout, and a ground-level display.

Using a built-in microcomputer, the model V-1070 displays information such as vertical deflection factors, uncalibrated and magnification warning, vertical input coupling, band limiter, and channel 2 inversion. Further vertical deflection factors and sweep times are displayed on the terminal, with the converted values at the magnified modes shown automatically. Additional features include four channels with independent position controls, eight-trace with alternate sweep, and a maximum sweep time of 2 ns per division.

Available in September, the 22-lb scope will be priced at less than $2,000.

Hitachi Denshi America Ltd., 175 Crossways Park W., Woodbury, N.Y. 11797.
Phone (516) 921-7200 [Circle 366]

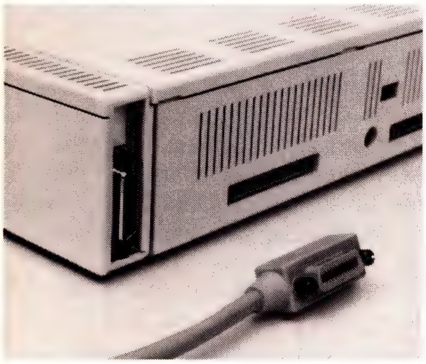
## Hardware, software makes PCjr an instrument controller

**A package of hardware** and software that converts the IBM Corp. PCjr into a low-cost instrument controller offers a utility similar to that provided by the company's IEEE-488 interface for the IBM PC.

The software includes two levels of interface software functionality, a configuration utility, diagnostics, and an interactive control program used for troubleshooting and as an application software development tool. A set of primitive IEEE-488 commands, which require a solid understanding of the IEEE-488, let the sophisticated user manipulate the data management and handshake lines. Simple high-level commands automatically handle addressing, bus management, and handshaking. The GPIB system software is installed as part of the operating system, allowing the system to manage it.

The GPIB-PCjr, which is added to the PCjr's input/output expansion bus, is priced at $385, and is available now. The software, which includes an Interpretive Basic interface, sells for $75.

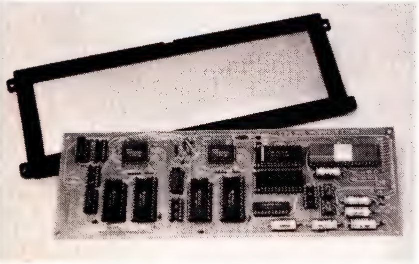
National Instruments, 12109 Technology Blvd., Austin, Texas 78727. Phone (800) 531-5066 [Circle 367]



## LCD controller builds IBM PC-compatible displays

**IBM Personal Computer**-compatible alphanumeric and graphic presentations can be made on a dot-matrix liquid-crystal display, thanks to the CDS300-4 controller. This model supports 128-by-480-pixel resolution and is designed for original-equipment manufacturers' front-panel or terminal requirements in industrial, scientific, engineering, and medical LCD-module applications.

Using the CDS300-4 controller, engineers can easily interface to an IBM PC, remote ASCII keyboards, or external microprocessor systems.



The controller's internal character generator includes a 5-by-7 font for 16 lines of 80 characters with scrolling or a 7-by-11 font for 12 lines of 40 characters with graphics and scrolling. Internal graphics-generation capabilities include simple primitives for lines, rectangles, squares, circles, reverse video, and pixel drawing in a fully bit-mapped screen.

The controller, which measures 4 by 10 in., can be interfaced through an RS-232-C or parallel port and requires only 5 V for operation. Samples are available now at $790 each. In lots of 500 pieces, the controller is priced at $290 each, according to the company.

UCE Inc., Communications & Display Systems, 24 Fitch St., Norwalk, Conn. 06855. Phone (203) 852-9814 [Circle 352]

## Interface lets logic designs be uploaded for processing

**An interface**, the NX-TDL, allows engineers using the company's software to upload logic designs to the Tegas simulator for advanced processing. The NX-TDL converts net lists generated from the company's logic designs into the Tegas format.

Tegas is a software package designed for minicomputers and mainframes that simulates logic for chips ranging in size up to very large-scale integrated circuits as well as entire systems. The NX-TDL electronic design software permits the design and simulation of logic for printed-circuit boards and ICs, along with the physical layout of pc boards. All the programs work in the package with IBM Corp. Personal Computers as well as with Texas Instruments' Professional Computers.

Priced at $500, the NX-TDL is available now.

Personal CAD Systems Inc., 981 University Ave., Los Gatos, Calif. 95030.
Phone (408) 354-7193 [Circle 375]

## Dual-display drafting system improves users' visualization

**A drafting system** called the Producer II includes two 19-in. monochromatic graphic displays, a controller with a 27-megabyte Winchester disk drive, the DMP-52 sheet-fed plotter,

VACTEC
OPTOELECTRONICS
PHOTOCONDUCTORS
(LIGHT DEPENDENT RESISTORS)
CdS CdSe

**VACTEC LDR's** are photoconductive cells responding to visible light by proportional resistance change.

**VACTEC LDR's** are rated at 500 peak V for use in 115 and 230 VAC direct relay controllers, SCR and triac gating.

Their small size, low cost, and spectral range of 400-700 nm make LDR's an excellent ambient light sensor for day/night threshold controls, automatic brightness controls for CRT terminals, TV sets, digital clocks, automotive, and aircraft instrument displays. Apply them as any variable resistance.

Request Bulletin PCD-6.

EG&G VACTEC
10900 Page Blvd.
St. Louis, Mo. 63132
(314) 423-4900
TWX 910-764-0811

Circle 91 on reader service card

menu pad, work station desk, and a library of 5,000 predrawn figures. All hardware and software is compatible with the company's existing line of drafting systems.

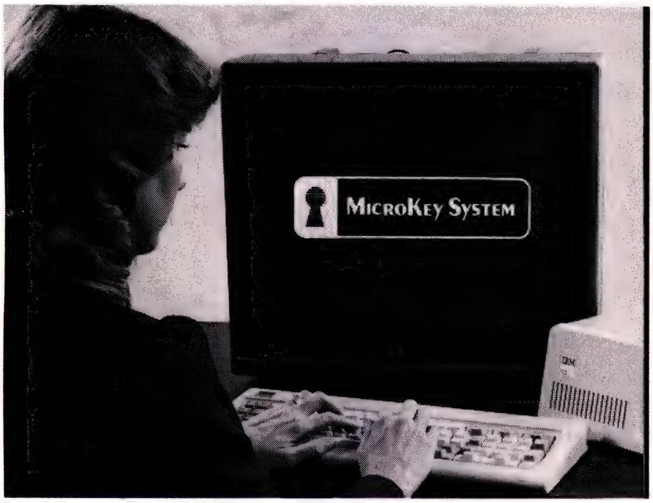
With a resolution of 1,024 by 800 pixels, the displays are able to improve design visualization by showing the entire drawing on one screen while detail work is being completed on the other. Each of the intelligent raster displays has an MC68000 graphics processor for performing such operations as instantaneous pan, zoom, and local redisplay.

The servo-driven DMP-52 plotter offers pen speeds of up to 22 in./s and a resolution of 1/1,000 in. The single-sheet paper feed produces C- or D-size ink originals on paper, vellum, or polyester film.

Available now, the Producer II sells for $41,900.

Bausch & Lomb, Interactive Graphics, P.O. Box 14547, Austin, Texas 78761. Phone (512) 837-8952 [Circle 374]

## Board lets text, graphics be overlayed on video



**A plug-in circuit board** for the IBM Corp. Personal Computer allows the overlay of computer-generated text and graphics on any incoming video source. Without special programming, any off-the-shelf software for the PC can be used to combine video with computer-generated text and graphics in a simultaneous display. The PC-MicroKey System is based on the company's systems for Apple II computers.

Suitable for applications such as interactive training stations and point-of-sale terminals, Level I is a low-cost red-green-blue-only system designed for use with video disk players equipped with external synchronization. A Sony KX series monitor, or equivalent, is required.

Level II adds broadcast-quality NTSC composite video output to the RGB capability of the Level I system. Level II allows the flexibility of overlaying not only the output of video disk players, but also any video tape player, still-frame video tape, or camera. This combined display can be broadcast and recorded, making it useful for video production.

Level I is priced at $900 and Level II goes for $1,805. Deliveries take up to four weeks after receipt of order.

Video Associates Labs Inc., 3933 Steck Ave., Suite B-106, Austin, Texas 78759.
Phone (512) 346-5781 [Circle 359]

## Multitasking work station employs both 8086, 8087

**The GC-1000 series** is a multitasking, multiuser work station based on the 16-bit, 8086 processor with local random-access memory and mass storage. The series converts any of the company's D-SCAN GR-1100 or GR-2400 series of color graphics terminals into a work station designed for high-resolution graphics applications.

The GC-1000 uses an 8087 coprocessor to accelerate floating-point calculations, and runs the Concurrent CP/M multitasking operating system. It offers local programmability and intelligence, off-loads tasks from host computers, and streamlines communication.

The model 1020 consists of 256-K bytes of RAM, one 5¼-in. 655-K-byte floppy disk, a bidirectional Centronics-compatible parallel interface, and four serial input/output ports. The system can be expanded to 1 megabyte of RAM. The model 1030 adds a four-slot Multibus card cage with three slots available for specialized applications, such as additional memory or special-purpose boards. Standard languages available include C, Basic, and Fortran.

Prices of models in the GC-1000 series start at $4,950; delivery takes 120 days.

Seiko Instruments U.S.A. Inc., 1623 Buckeye Dr., Milpitas, Calif. 95035. Phone (408) 943-9100 [Circle 358]

## 1,000-W switcher employs load-management features

**A 1,000-W** switching power supply has three load-management techniques for optimizing parallel operation—thermal stress sharing, downslope regulation, and selective overvoltage shutdown. With the first feature, the supplies can equalize thermal stress by limiting any individual unit's output power in proportion to its internal temperature rises, helping to avoid premature shutdown.

If an overtemperature condition becomes excessive,

however, a switch will prevent damage. By monitoring the output current, the downslope regulation gradually reduces the output voltage; other parallel-connected supplies pick up more load. Selective overvoltage permits parallel operation without expensive diode isolation.

If any unit goes into an overvoltage condition, the remaining units continue operating because of their higher overvoltage trip-point settings. The model FS102B5's input specifications are 176 to 264 V ac and 47 to 63 Hz, with front-panel-accessible input fusing. Output is 200 V dc at 200 A and voltage is adjustable to ±10%; remote sense compensates for up to an additional 500-mV load cable loss.

The model FS102B5 sells for $850 per unit and is now available in sample quantities.

Lorain Products, Dept. 710, 1122 F St., Lorain, Ohio 44052. Phone (216) 288-1122 [Circle 381]

---

## Insertion systems mount nonstandard components

**A series** of component-insertion systems are built for loading circuit boards with components that have nonstandardized configurations. The model CIM-735 uses an IBM 7535 robot equipped with the company's End-of-Arm Rotary Gripper Turret and can be adapted to all densely packaged boards, including multilayers.

Components such as light-emitting diodes, chokes, switches, and sockets that cannot be mounted by conventional means are positioned and inserted at cycle rates as high as 2,000/h. Although the CIM-735 is usually configured for four-component insertion, six- and eight-position turrets are available as well. Both the selection of parts and the insertion routine can be programmed using a bar-code reader or optical recognition techniques, according to the company.

Prices of the CIM-735 start at $75,000. Deliveries take up to 16 weeks.

Aidlin Automation Corp., P.O. Box 13125, Sarasota, Fla. 34278. Phone (813) 756-0641 [Circle 371]

---

## Laser system trims thick-film resistors fast

**A high-speed** laser system that trims thick-film resistors features a high-speed beam deflection system, a high-peak-power neodymium yttrium aluminum garnet laser, and a self-calibrating measurement system. The model 4000 achieves a 2.5-μm resolution with a 10-μm positioning repeatability.

The system's compact positioning subsystem consists of two rotating mirrors mounted orthogonally, providing a two-axis field beam deflection. An F-theta lens is used to keep laser spot size distortion over the trim field to less than 2%. A high-peak power laser, the company's model 3573 Nd:YAG, provides the critical Q-switched laser parameters needed for trim quality and speed.

The model 4000's measurement system, with a built-in differential voltmeter, is optimized for high-speed trimming of both resistance and dc voltage. Resistance measurement accuracy at midrange is to within 0.02%.

The model 4000 is expected to be available sometime in early 1985.

Electro Scientific Industries Inc., 13900 N.W. Science Park Drive, Portland, Ore. 97229.
Phone (503) 641-4141 [Circle 372]

---

## Automated tab-plating unit keeps gold usage low

**A microprocessor-controlled** automated machine for tab-plating printed wiring boards reduces lead-time loss at the beginning of a shift and improves consistency and reliability in production by constantly monitoring process parameters. The Tabmaster also features an automatic load/unload option that can reduce operator involvement to as little as 5 min/h.

The patented Tabmaster plating cell, in combination with the company's ATP System chemical processes, can cut gold costs by reducing variance in gold thickness to less than 10%, the firm says. The system's plating-cell design also permits higher plating current densities, resulting in a compact, highly productive machine, thanks to shorter cell lengths.

All electroplating stages have separate rectifiers for the front and rear of the boards to allow for variations in tab areas. The Tabmaster has a self-diagnostic capability, and its cassette operation permits easy alteration of programs. At a base price of $68,900, the Tabmaster is available in 8 to 12 weeks.

Plating Systems, OMI International Corp., 75 River Rd., Nutley, N.J. 07110. Phone (201) 667-5200 [Circle 373]

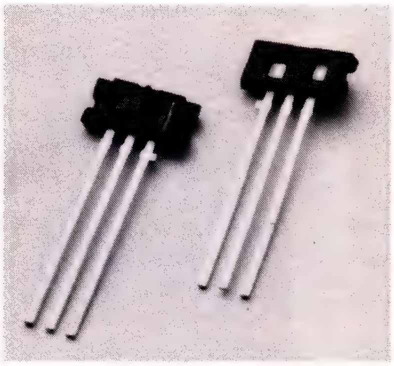
---

## Small optical sensor comes in improved package

**A small reflective** optical sensor, the model SFH 900, has been reintroduced in an improved package with three coupling factors and lead lengths of either 5.6 or 14.3 mm. The sensor, a miniature reflex light barrier for short distances of up to 5 mm, includes a gallium arsenide infrared diode as a transmitter and a large-area phototransmitter as a receiver. High sensitivity is ensured by a

1-mm$^2$ radiation-sensitive area and a current gain of almost 1,000.

Sensor components are manufactured in a strip-line technique and are mounted side by side in a thermoplastic package. A daylight filter screens for unwanted ambient light effects.



The 2.2-mm-high sensor is especially well-suited to applications where ordinary sensors are too large. It can be used in industrial and entertainment equipment that senses motion, monitors speed, or reports location.

In 1,000-piece orders, prices of the sensor, available now for immediate delivery, vary from $2.10 to $2.15.

Siemens Components Inc., Optoelectronics Division, 19,000 Homestead Rd., Cupertino, Calif.
Phone (408) 257-7910 [Circle 370]

---

## Signal-processing package offers 30 programs for PC

**A subset** of the company's Interactive Laboratory System signal-processing software has been ported to the IBM Personal Computer and PC XT. Called the ILS-PC 1, the software offers PC users a signal-processing package with over 30 integrated programs providing data-acquisition support, waveform display and editing, digital filtering, and spectral analysis.

The data-acquisition feature includes support of certain vendors' analog-to-digital and digital-to-analog conversion hardware. Waveform-related features include graphical display and cursor editing of signals. Digital filtering abilities include the design of elliptic, Butterworth, and Chebychev filters and their application to filter time series data. Spectral analysis functions encompass fast Fourier transform, Cepstrum, and two-dimensional and three-dimensional graphical displays of spectra.

Applications for the ILS-PC 1, which requires 256-K bytes of memory and a graphics board running DOS 2.1, include speech analysis, noise and vibration, seismology, acoustics, and sonar. Available now, the ILS-PC 1 license fee sells for $1,495.

ILS Sales, Signal Technology Inc., 5951 Encina Rd., Goleta, Calif. 93117 Phone (800) 235-5787 [Circle 362]

---

## Modula-2 tools operate on IBM, Apple computers

**A range of software tools** are intended for use by developers of the Modula-2 programming applications and include Modula-2 compilers, interpreters, and Pascal-to-Modula-2 source-code converters for IBM Corp. Personal Computers and its compatibles as well as for Apple Computer Inc.'s Macintosh, Lisa, and Apple II line.

The version for Macintosh features enhanced bit-mapped graphics support, while the version for the Apple II line offers extended memory support. The IBM version features extended bit-mapped graphics support under MS-DOS 2.0. All Modula-2 compilers and interpreters support direct interrupt handlers.

The Pascal-to-Modula-2 source-code conversion program is especially suitable for systems houses with large investments in Pascal programs. When Pascal programs exhaust the processing power of existing hardware, they can be converted to Modula-2 and run on the company's Lilith Modula-2 hardware engines.

The Modula-2 compiler and interpreter are combined into one $90 package, and the converter sells for $100.

Modula Corp., 950 University Ave., Provo, Utah. 84604. Phone (801) 375-7400 [Circle 363]

---

## Software lets computer edit ladder-logic diagrams

**Intended for editing** and documenting ladder-logic diagrams in process-control applications, the Ladder Documentor software program is designed for use with the company's System 830 desktop computer. Data from the computer can be viewed at any time, and the user can display the ladder listing in part or in its entirety, inserting changes, corrections, and comments as desired.

In both cases, information may be shown on the system's screen, printed on the internal dot-matrix printer, or reproduced in up to eight colors on an optional plotter. The software also permits selective output generation from start rung to end rung or from start contact number to end contact number. It uses a cumulative error listing summary, input/output usage listing, and on-screen search for individual symbols and displays.

Available now, the software comes with the company's System 830 microcomputer, which is priced at $3,995.

Sumicom Inc., 17862 E. 17th St., Tustin, Calif. 92680. Phone (714) 730-6061 [Circle 364]

---

## Tools let expert systems be designed on TI computer

**A package** lets software developers design and deliver expert systems on the Texas Instruments Professional Computer. Programs designed with the Personal Consultant tools can help solve problems by using some of the same techniques employed by human experts, such as rules of thumb developed from experience and the ability to work with uncertain information.

The tools can be used to prototype and develop applications in such diverse areas as tax and investment counseling, loan analysis and approval, and automotive problem diagnosis. A designer using the software can develop an expert system with as many as 400 production rules. Larger expert systems encompassing more rules can be adapted to run on the Professional Computer when developed on a higher-capacity system.

The system uses a window-oriented point-and-select technique, letting users select from a list of alternatives. Selections can also be made by typing in only the first letter.

Selling for $3,000, the system includes the software, two sample knowledge bases, and the IQLISP programming language and documentation. Shipments will begin in the fourth quarter, and a three-day training course will be offered at a price of $1,500.

Texas Instruments Inc., Data Systems Group, P.O. Box 809063, Dallas, Texas 75380. Phone (800) 527-3500 [Circle 361]

## Ku-band converters provide reliable satellite reception

**Two Ku-band** block-down converters provide satellite video reception on smaller antenna sizes with a typical noise rating of 2.3 dB. The model LNB-25P uses a CR-62 antenna interface, while the LNB-25PW uses a WR-75. The converters operate in the 11.7 to 12.2 GHz portion of the Ku band.

The converters are powered by a low dc voltage.

The waterproof converters are available now for $400 each when ordered in quantities of 1 to 99.

Panasonic Industrial Co., One Panasonic Way, Secaucus, N.J. 07094. Phone (201) 348-7183 [Circle 368]

## Dial-back security device operates with Smartmodem

**A dial-back access** authenticator called Sleuth is designed to work with the Hayes Smartmodem or any of several Smartmodem-compatibles. Installed between the computer and Smartmodem, Sleuth prevents unauthorized use of data ports by requiring all potential users to type in an identification and password. After verifying the information, Sleuth dials the user and establishes a connection.

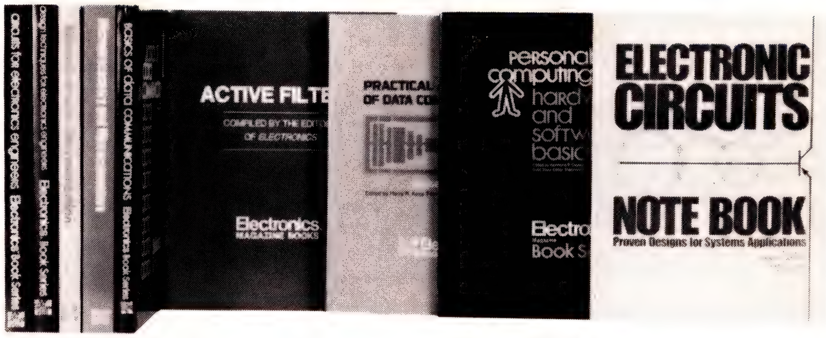
Sleuth, priced at $465, includes the unit, power supply, and an RS-232-C cable, and is available now.

C.H. Systems Inc., 8533 West Sunset Blvd., Suite 106, Los Angeles, Calif. 90069. Phone (213) 854-3536

[Circle 369]

Published by Electronics Week Magazine...

Books of special interest to our readers


Circuits for electronics engineers
Basics of Data Communications
ACTIVE FILTE
Electronics
PRACTICAL OF DATA CO
personal computing hard and softw basic
Electro Book S
ELECTRONIC CIRCUITS NOTE BOOK
Proven Designs for Systems Applications

**Circuits for Electronics Engineers**
Almost 350 diagrammed circuits arranged by 51 of the most useful functions for designers. Taken from the popular "Designer's Casebook" of *Electronics*, these circuits have been designed by engineers for the achievement of specific engineering objectives. Pub. 1977, 396 pages, softcover.
*Order No. R-711, $17.95.*

**Electronic Circuits Notebook**
Contains 268 completely illustrated electronic circuits conveniently arranged by 39 vital functions, including amplifiers, audio circuits, control circuits, detectors, converters, display circuits, power supplies and voltage regulators, function generators, memory circuits, microprocessors, and many others, as published in *Electronics* magazine 1977-1980. Companion volume to *Circuits for Electronics Engineers*. Pub. 1981, 344 pages, softcover.
*Order No. R-026, $17.95.*

**Design Techniques for Electronics Engineers**
Expert guidance at every point in the development of an engineering project—making measurements, interpreting data, making calculations, choosing materials, controlling environment, laying out and purchasing components, and interconnecting them swiftly and accurately. Nearly 300 articles from *Electronics*' "Engineer's Notebook," with more than 500 diagrams and tables. Pub. 1977, 370 pages, softcover.
*Order No. R-726, $17.95.*

**Microelectronics Interconnection and Packaging**
Articles from *Electronics* include sections on lithography and processing for integrated circuits, thick- and thin-film hybrids, printed-circuit-board technology, automatic wiring technology, IC packages and connectors, environmental factors affecting interconnections and packages, computer-aided design, and automatic testing. Pub. 1980, 321 pages, softcover.
*Order No. R-927, $15.95.*

**Order today using this coupon!**

**Microprocessors and Microcomputers: One-chip Controllers to High-end Systems**
Practical orientation to all aspects of microprocessors and microcomputers in 95 articles from *Electronics* covering low-end microcontrollers, mid-range microprocessors, high-performance 16-bit microprocessors, high-speed bipolar processors, peripheral support chips, signal processors, board-level microcomputers, software and applications. Pub. 1980, 482 pages, softcover.
*Order No. R-011, $18.95.*

**Basics of Data Communications**
This compilation of essential articles from *Data Communications* magazine includes chapters on terminals, acoustic couplers and modems, communications processors, networking, channel performance, data link controls, network diagnostics, interfaces, and regulations and policy. Pub. 1976, 303 pages, softcover.
*Order No. R-608, $15.95.*

**Practical Applications of Data Communications**
Selected articles from *Data Communications* magazine cover architecture and protocols, data-link performance, distributed data processing, software, data security, testing and diagnostics, communications processors, and digitized-voice and data-plus-voice. Pub. 1980, 424 pages, softcover.
*Order No. R-005, $17.95.*

**Personal Computing: Hardware and Software Basics**
More than 50 articles from leading publications provide information on personal computing hardware, software, theory and applications. Pub. 1979, 266 pages, softcover.
*Order No. R-903, $15.95.*

**Active Filters**
Covers the theory and practical implementation of filter networks built with active elements. Includes design tables and computer/calculator programs, as published in *Electronics*. Pub. 1980, 133 pages, softcover.
*Order No. R-003, $11.95.*

**ELECTRONICS WEEK BOOKS**
McGraw-Hill Inc. Princeton Road
Hightstown, N.J. 08520
(Tel.) 609/426-5070

McGraw-Hill Intl. Publications Co.
European Circulation Center
Maidenhead, Berks. SL6 2QL, UK
(Tel. [0628] 23431; Telex 848640)

| Order # | Qty | Price |
|---|---|---|
| R- | | $ |
| R- | | $ |
| R- | | $ |
| R- | | $ |
| R- | | $ |

Name

Title

Company

Street/PO address

City/State/Zip (Outside USA: City/postal code/country)

☐ Payment enclosed (Payment must accompany orders under $25. USA residents add applicable local tax.)
☐ Bill my company (or attach company Purchase Order)
☐ Bill me

Ten-day money-back guarantee applies on all books.

COLCOAT 515
STOPS
Electrostatic
Damage

Protect delicate LSI and IC chips from electrostatic damage with COLCOAT 515, a unique, alcohol-based liquid. One application of COLCOAT 515 on a chip carrier case prevents electrostatic buildup for more than two years. It dries quickly to form a tough, protective coating.

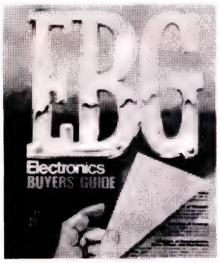
Japan's leading electronics makers use COLCOAT 515 because of the almost 100% perfect protection it affords. The incidence of rejection due to damage from static electricity is less than one in a million. Specify COLCOAT 515 to ensure the damage-free deliveries your customers want.

COLCOAT CO., LTD.
3-28-1 Omori-nishi, Ota-ku, Tokyo 143, Japan.
Phone: (03) 762-8526. Telex: 0246-7481 COLCOT J

Circle 96 on reader service card

NOW AVAILABLE!

1984-85
Electronics Buyers' Guide



The industry's most often-used directory:

- Lists more than 4000 products.
- Lists over 5000 companies.
- FREE current catalog retrieval service.

Price: $40
In the U.S. and Canada.

Send order with payment to:
Regina Hera
Electronics Buyers' Guide
1221 Avenue of the Americas,
N.Y., N.Y. 10020

# Letters

## A different first

**To the editor:** The item "Data General unwraps its CAE family" (June 28, 1984, p. 41) says that Data General Corp.'s new Distributed Systems series of engineering work stations was the first to use Texas Instruments Inc.'s 256-K random-access memories.

This is incorrect; however, the DS series is the first work station to use TI's TMS4161 Multiport Video RAM, a 64-K DRAM that has been designed for use with graphics applications.

Roger Fisher
Texas Instruments Inc.
Houston, Texas

## Fidelity to fact

**To the Editor:** Your editorial on the movie "WarGames" (June 16, 1983, p. 120), which condemned the movie for, among other things, technical inaccuracy, contained some glaring technical errors itself. For example, you said 5¼-in. floppy disks would be more appropriate to the hobbyist. However, the computer the young hero uses is an IMSAI 8080, which used 8-in. floppies.

The intent of the movie was not to make the computer the archvillain; that was your interpretation. The message the movie conveyed was that no one will win a nuclear war.

Mike Miller
Wilton, Conn.

## The herd instinct

**To the Editor:** It cannot go unnoted that the Semiconductor Industries Association is trying to stop field-targeting practices by Japan. What the Japanese and associations like that are attempting indicates a misunderstanding of market economies.

There is an incipient market for semiconductor-based products in the Third World that will make current volumes look paltry. Let absolute free trade work, and the U. S. will have earned its share of that business. Impose reciprocal protective tariffs and, as history teaches, we will be cut out of those future markets.

History should also show that we should not worry about what the Japanese are doing; they are digging their own grave. I hope your magazine will not urge us to follow suit.

Hugh K. Drake
Fort Collins, Colo.

## The naked emperor

**To the editor:** Congratulations on your editorial "High technology may not be the unemployment panacea" (May 31, 1984, p. 12). You have joined those of us who recognize—and are not afraid to point out—that the emperor is indeed naked.

It is no accident that such anti-engineer organizations as the American Electronics Association, the Massachusetts High Technology Council, and the Institute of Electrical and Electronics Engineers have not denounced the myth of economic growth through high technology. Only the professors and the corporate executives who dominate these groups profit from the glut of technical professionals.

Irwin Feerst
Committee of Concerned EEs
Massapequa Park, N.Y.

## Common confusion

**To the editor:** "Micro-Winchesters lure more makers" (May 31, 1984, p. 45) reflected a common confusion about the products and marketing direction of SyQuest Technology, of Fremont, Calif. While you are correct in reporting that SyQuest continues to favor 3.9-in. media, a SyQuest drive's footprint is that of its standard half-height 5¼-in. counterpart. Other manufacturers do mix removable and fixed technologies in one full-size drive, but SyQuest manufactures half-height fixed-only and removable-only drives—not, as reported, a combination drive.

Holly L. Billings
R. L. Couch Public Relations
Irvine, Calif.

---

## Correction

*In "Cray parlays four processors into a gigaflop machine," (July 23, 1984, p. 40), the spawning grounds of ETA Systems Inc. were incorrectly identified. The new supercomputer company is a spin-off of Control Data Corp., Minneapolis.*

A McGraw-Hill Electronics Publication

# INDUSTRIAL ELECTRONICS EQUIPMENT DESIGN

This new bi-monthly magazine offers advertisers a unique way to target their messages to 25,000 electronic design engineers concerned specifically with the design and manufacture of industrial electronics equipment.

It will be devoted entirely to international coverage of this important segment of the electronics industry. It will be produced by its own experienced team of technical editors. They are dedicated to providing readers with the most technically complete and accurate information available. Typical contents of each issue are as follows:

## Representative table of contents.

**News and trends.**

CAD: New work-station software generates test patterns
Components: Voice recognition boards reach market
Control: IBM and GE team up in process-control thrust
Careers: Industry supporting master's programs in manufacturing

**Industry briefs, people and plants.**

Eaton's Jim Bowen; Hitachi's move to CAD

**Technical Articles.**

Cabling techniques in industrial control systems, by Joseph Cable and Sam Control, ITT Industrial Systems.

How to set up quality engineering database with LISP, by P.K. Wrigley, Lisp Systems, Inc.

Designing programmable motor controls with a microprocessor, by V.K. Krishna, Calcutta Electronics.

Flexible programming language simplifies robot control, by T.M. Larson and A. Coppola, Unimation, Inc.

**Design notes:** Timer-Converter generates ramp for chart recorders; Industrial ammeter measures 10-A peaks; Wideband radiation monitor

**New products.**

- Test and measurement equipment
- Components
- Production equipment
- Control equipment
- CAD/CAM
- Materials
- Services
- New Literature

**Departments.**

- Editorial
- Letters
- Meetings
- New Books

## Special 1984 introductory rates.

| Ad size. | ElectronicsWeek advertisers. | Non ElectronicsWeek advertisers. |
|---|---|---|
| 1 page: | $1,000 | $1,500 |
| 2/3 page: | 750 | 1,125 |
| 1/2 page: | 620 | 930 |
| 1/3 page: | 400 | 600 |
| 1/4 page: | 320 | 480 |
| 1/6 page: | 220 | 330 |

**Cover rates.**

| | | |
|---|---|---|
| 4th cover: | $2,160 | $2,635 |
| 3rd cover: | 1,710 | 2,260 |
| 2nd cover: | 1,810 | 2,410 |

**Color charges:**

| | |
|---|---|
| Two color, standard: | $305 |
| Matched 2nd color: | 510 |
| 4 color process: | 610 |
| 4 color process spread: | 950 |

**1984 Issue dates.**

September 15, 1984
November 15, 1984

**1984 Closing dates.**

August 28, 1984
October 15, 1984

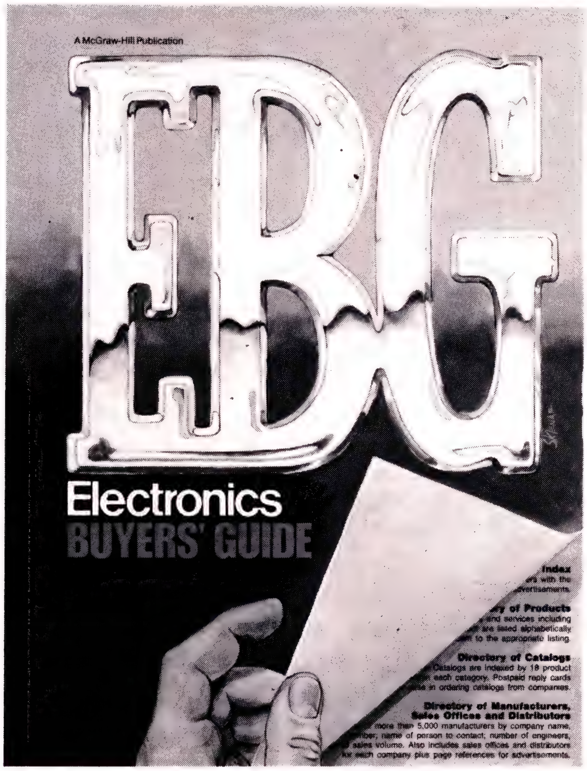
For space reservations, call Production Dept.,
**McGraw-Hill Electronics Publications, (212) 512-3140,**
1221 Avenue of the Americas
New York, NY 10020

**Circulation: 25,000 industrial electronics equipment design engineers worldwide.**

# The *only* electronics directory you need...
# 1984-85 Electronics Buyers' Guide

**Now available: 1984-85 Electronics Buyers' Guide.** Completely new listings of catalogs, new phone numbers, new addresses, new manufacturers, sales reps, and distributors! The total market in a book—**three** directories in one!

**1.**
Directory of products. Over 4,000 products, over 5,000 manufacturers.


A McGraw-Hill Publication
EBG
Electronics
BUYERS' GUIDE
Index
of Products
Directory of Catalogs
Directory of Manufacturers, Sales Offices and Distributors

**2.**
Directory of catalogs. Includes six post-paid catalog inquiry cards for 10-second ordering.

**3.**
Directory of manufacturers. Local sales offices, reps, and distributors, with phone numbers. Number of employees and engineers, dollar volume, name of company contact.

**The only book of its kind in the field.**

**If you haven't got it, you're not in the market.**

**To insure prompt delivery enclose your check now.**

| | |
|---|---|
| **Write to:** | Regina Hera<br>Electronics Buyers' Guide<br>1221 Avenue of the Americas<br>New York, New York 10020 |
| **Enclose check for:** | • $40 for each copy delivered in U.S. and Canada.<br>• $50 for each copy delivered elsewhere. (Add $20 for air mail). |

Make Check payable to: Electronics Buyers' Guide.

# New Literature

**Network guide.** A users' manual, available at no charge, fully describes the theory of operation of an Ethernet transceiver. Complete instructions for the successful installation of an Ethernet transceiver, along with detailed descriptive illustrations of the installation process as well as instructions for testing the Ethernet transmission system are also included. In addition, the manual describes the installation and operation of the NT100, the company's IEEE-802.3 transceiver. For a copy, call (617) 692-3900 or write to Interlan Inc., 3 Liberty Way, Westford, Mass. 01886. [Circle reader service number 421]

**Networks untangled.** The latest edition of the *LOCALNetter Designer's Handbook*, a 458-page guide to the specification, design, and selection of local nets, includes product descriptions for local network systems and accessories, articles on major design issues, articles on what are viewed as IBM's and AT&T's local network strategies, descriptions of proposed as well as de facto standards, and comparison notes on equipment features. The book also includes an extensive bibliography. The 1984 edition of the handbook is priced at $77 and may be ordered by calling (612) 9235-2035 or by writing to Architecture Technology Corp., P.O. Box 24344, Minneapolis, Minn. 55424. [Circle 426]

**IC processes.** Representing the distillation of information gathered over the last three years, a guide to all aspects of integrated-circuit fabrication covers all major wafer processing and IC packaging operations, with emphasis on the equipment and materials used in each step. *Practical Integrated Circuit Fabrication* is not intended to be a process recipe book, but is a detailed overview of the practical aspects of each operation. Although a dozen IC processes are covered, from TTL to HMOS, an advanced silicon-gate complementary-MOS process (HCMOS) is highlighted and detailed through 110 process steps. The 350-page guide, extensively illustrated, is priced at $495, postage paid, and can be ordered by writing to Integrated Circuit Engineering Corp., 15022 North 75th St., Scottsdale, Ariz. 85260 or by calling (602) 998-9780. [Circle 425]

**Crazy glue.** Of interest to anyone responsible for specifying adhesives with critical performance parameters may be an application note that covers the complete range of analytical testing performed on epoxies. Each test is discussed, relating the determination of specific epoxy properties that may effect performance in your specialized application. A detailed description of the test equipment is also included. For a copy of the free application note contact Epoxy Technology Inc. by calling (800) 227-2201 or (617) 3805 from Massachusetts, or writing P.O. Box 567, 14 Fortune Dr., Billerica, Mass. 01821. [Circle 422]

First in quality assurance . . .
. . . first in product reliability.

**Clear sounds.** Taken from a presentation to the IEEE Vehicle Technology Group Seminars, a paper describes the application of "On-Glass" communications antenna technology to the development of 800-MHz mobile antennas for cellular applications. The paper analyzes the theory of "On-Glass" technology, which uses a vehicle's window for capacitive coupling, and reports on the procedures followed for developing the required collinear radiator and the broadband coupling system to achieve gain and a low voltage standing-wave ratio. A reprint is available from The Antenna Specialists, Marketing Dept., 12435 Euclid Ave., Cleveland, Ohio 44106. [Circle 423]

**Clean air.** Air pollution, specifically the toxic boron trichloride, silicon tetrachloride, and similar fumes generated in plasma etching, vapor deposition, and epitaxial deposition, is addressed in an applications note. The note summarizes available abatement techniques, and describes the equipment, its operating principles and selection criteria that are available from Heat Systems-Ultrasonics. Titled *Air Pollution in the Semiconductor Industry*, the note tabulates processes, contaminants generated, and removal recommendations. For additional information or for a copy of the note call (516) 694-9555, or write to Heat Systems-Ultrasonics Inc., 1938 New Highway, Farmingdale, N.Y. 11735. [Circle 424]

**Product evaluations.** *Communications Product Reports* provides evaluations of switching equipment, local networks, modems, multiplexers, communications processors, communications controllers, front-end processors, communications carrier services, telephones, terminals, printers, and test equipment. Included with each subscription to the reports is the company's telephone information service. For more information, call (609) 428-1020 or write to Management Information Corp., 140 Barclay Center, Cherry Hill, N.J. 08034. [Circle 427]

**Users' notes.** A new periodical publication, *OakNotes*, will serve users of IBM S/34, S/36, and S/38 computers. Every issue will feature a tip-of-the-month, which will be a performance tip that can be acted on immediately by nontechnical personnel to improve system performance; and a buy-of-the-month, which will be a featured product of high quality at a reasonable price. *OakNotes* is offered free of charge by calling (813) 441-4997 or write to Oak Software, 1384 Pierce St., Clearwater, Fla. 33516. [Circle 428]

# EMPLOYMENT OPPORTUNITIES

## POSITIONS VACANT

**Staff Scientist — $1986-$4767 — Lawrence Berkeley Laboratory (LBL)** — The Electronic Materials Program of LBL's Center for Advanced Materials is seeking a staff scientist to conduct research in the area of optical and electrical properties of III-V compound semiconductors. Research focuses on the development and application of advanced characterization techniques for the study of GaAs single crystals and special multilayer structures which will be grown at the Center, Project involves collaboration with other staff scientists and supervision of graduate students. Requires several years' experience in the field of compound semiconductors; experience in the characterization of III-V semiconductors using optical and electrical techniques; strong theoretical knowledge coupled to the interpretation of experimental results and experience in graduate student supervision. Ph.D. in solid state or semiconductor physics strongly preferred. Please send inquiries with two professional resumes and other appropriate material to: Lawrence Berkeley Laboratory, Employment Office, 90-1042, One Cyclotron Road, Berkeley, CA 94720. Please specify Job #A-3031. An Equal Opportunity Employer M/F/H.

**Murkett Associates — Technical Mgmt** placement with national affiliates-fee paid. Box 527, Montgomery, AL 36101.

## POSITIONS WANTED

**Switching Power Supply Designer for hire** — State-of-the-art, up to 1 KW, 200 KHZ. In less time, less expensive. Contract or per diem. (514) 683-0016.

**Microcomputer Expert for hire. Contract or** perdiem. Programming, products with a brain, circuitry. Mr. Masel, 212-476-1516.

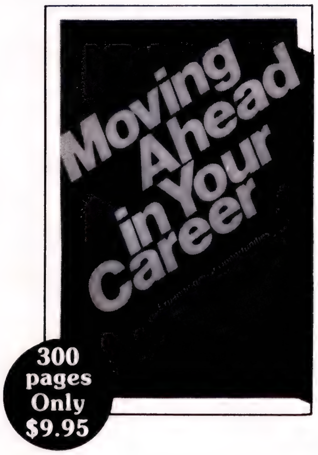
**Engineering Consultant for U.L., U.L.C., or** C.S.A. requirements. Call me for consulting, liaison, design aid. G. L. Schmitz 312-446-8775.

## RESUMES

**Resumes — Complete instructions and** examples; $4, Consultants, Box 567—J, Bergenfield, N.J. 07621.

# Are you in your first engineering job?

# Are you thinking about where you go from here?



This book is a practical how-to-do-it guide from Graduating Engineer that you can put to use right now—articles like "How to Get a Good Performance Appraisal", "The Importance of a Mentor", "The Road to $50,000 a Year", "Winning at Office Politics"—and many more. Send for this book today and begin to move ahead in *your* career.

**GRADUATING ENGINEER**
**P.O. Box 900**
**New York, NY 10020**

Please send me ___ copies of "Moving Ahead in Your Career" at $9.95 each. Enclosed is my check/money order made out to Graduating Engineer for $______

**Name**

**Address**

**City/State/Zip** E

# Advertise your software for only $107.25

For only $107.25 per inch you can advertise your software, designed specifically for the electronics industry, to a no-waste audience specifically in need of it—Electronics Week's paid circulation of 102,000 subscribers.

You'll waste no advertising dollars on waste circulation. These decision-makers need software applications designed specifically for their industry. That's why EWeek's Computer Software Section is a perfect interface because it is programmed to connect you with specific industry interests.

Send your copy/art to the address below. For more information, call David Emery at 212/512-2557.

## Electronics Week Computer Software Section

Post Office Box 900
New York, NY 10020

**1984 ELECTRONICS WEEK COMPUTER SOFTWARE SECTION**

| Sizes | | Material |
|---|---|---|
| 1 Inch | 7/8 x 2 1/4 | Artwork or |
| 2 Inch | 1 7/8 x 2 1/4 | film preferred. |
| 3 Inch | 2 7/8 x 2 1/4 | Typesetting |
| 4 Inch | 3 7/8 x 2 1/4 | free of charge. |

**1984 RATES**

| Unit | 1X | 6X | 12X |
|---|---|---|---|
| 1 Inch | $107.25 | $106.30 | $105.40 |
| 2 Inch | 214.50 | 212.60 | 210.80 |
| 3 Inch | 321.75 | 318.90 | 316.20 |
| 4 Inch | 429.00 | 425.20 | 421.60 |

Call
David Emery
212/512-2557

# SOFTWARE DEVELOPMENT TECHNOLOGISTS

TRW's Systems and Software Engineering Laboratory, located in McLean, VA, a suburb of Washington, D.C., is seeking highly talented and experienced software development engineers and technologists in the following areas:

## MANAGEMENT INFORMATION SYSTEMS

DBMSs, Large System Development experience, Distributed Data Bases and Control Concepts

## SOFTWARE ENGINEERING

Tools, Languages, Program Support Environments, Methodologies, Applied and Academic Background

## GRAPHICS

Work Stations, Commercial Software Packages, Prototyping Concepts, Man-Machine Interface

## DIGITAL SYSTEMS

Architecture/Requirements Orientation, Large System Level, knowledge of both Hardware and Software

## DISTRIBUTED NETWORKS/ COMMUNICATIONS

LANs, BIUs, OS Interface Protocols, Embedded Systems Emphasis

## INTEGRATION & TEST

Plans, Procedures, Execution and Monitoring for Mobile and Fixed Systems

These individuals should have 5 or more years of directly applicable experience. Degrees from BS through PhD in Computer Science, Math, or Engineering are desired.

Current openings encompass a large range of Hardware and Software systems, including . . .

- **Hardware — VAX, IBM, PDP, Data General (S230), Chromatics, MAP, IDM, M68000**
- **Operating Systems — VMS, UNIX, VM/CMS, SP, RDOS, ZRDOS, MVS, IDRIS**
- **DBMSs — ORACLE, GIM, M-204, INGRESS, INQUIRE**
- **Programming Languages — C, PL/1, FORTRAN, Ada, LISP, Pascal, Assembly**

Proof of U.S. Citizenship required (a background investigation may be conducted).

To explore these opportunities, please forward resume including salary history to:

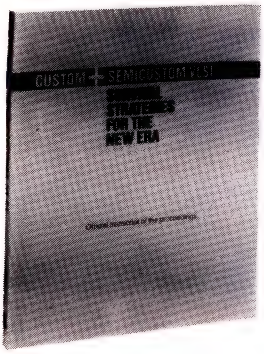
Personnel
TRW Defense Systems Group
Department PB
7600 Colshire Drive
McLean, Virginia 22102

An Equal Opportunity Employer M/F/H/V.

TRW

**A Company Called TRW**

**CUSTOM AND SEMICUSTOM VLSI:**
Survival Strategies
For The New Era



The semiconductor industry is changing. Are you equipped to meet the challenges of this ever-changing industry? Crucial decisions are at hand. *Electronics* Magazine and Gnostic Concepts Inc. sponsored this prestigious seminar and the transcript is now being made available to those who understand the challenge of these changes.

A panel of industry experts presents up-to-date, significant information that probes major technological concerns such as:

- Company benefits by custom design
- Economical appropriateness for tackling custom
- Evaluation of gate arrays and standard cells
- Alternate processes to explore
- Suitability of CAD systems to your particular company

The questions raised are ones of survival. And OPPORTUNITY.

Put this exclusive resource in your hands to help you make the right decisions.

**Don't hesitate—Order your copy today!**

Send $150 or your company purchase order to:
**Electronics Week Books**
McGraw-Hill Inc.
Princeton Road
Hightstown, N.J. 08520
(Tel.) 609/426-5070
Allow 4-6 weeks for delivery.
Money-back guarantee.

# Advertisers Index

| | | |
|---|---|---|
| ■ | **Advanced Micro Devices** | 50-51 |
| | **Astro Med** | 61 |
| ‡ | **Belden** | 22 |
| ■ | **Boonton Electronics** | 76 |
| ‡■ | **Cherry Electrical** | 7 |
| | **Colcoat Co. Ltd.** | 96 |
| | **Cypress Semiconductor** | 79 |
| | **ElectronicsWeek** | 73-75 |
| ■ | **John Fluke Mfg. Co.** | 55 |
| ■ | **Fujitsu Microelectonics** | 10-11 |
| ■ | **Futurenet** | 16 |
| ■ | **Hamilton/Avnet Electronics** | 4 cover |
| | **Hewlett Packard** | 9, 39, 49 |
| ■ | **Hoya Corporation** | 40 |
| | **Hughes Aircraft** | 45 |
| | **IBM—ISG Ind. Sector** | 26-27 |
| | **Kentronix Inc.** | 89 |
| ‡■ | **Kyowa Electronic** | 87 |
| ‡ | **Micro Component Technology** | 81 |
| | **Micrometals** | 89 |
| | **Monolithics Memories** | 14-15 |
| | **Moore Data Management** | 61 |
| *■ | **Murata Manufacturing** | 22 |
| | **National Instruments** | 8 |
| | **National Semiconductor** | 2 cover, 1 |
| ‡■ | **NEC Electronics** | 82-83 |
| ■ | **Newtech Company Ltd.** | 61 |
| ■ | **Nicolet Instrument** | 21 |
| ‡■ | **Panasonic** | 3 |
| | **Qualogy Inc.** | 34-35 |
| | **Ridge Computers** | 3 cover |
| | **SeeQ Technology, Inc.** | 46-47 |
| | **Solid State Scientific** | 5 |
| * | **Seiko Instruments & Electronics Ltd.** | 87 |
| *■ | **Siemens AG Munchen** | 3 |
| *■ | **Teac Corporation** | 81 |
| | **Teledyne-Brown Engineering** | 25 |
| | **Teledyne Crystalonics** | 80 |
| ■ | **Teledyne Relays** | 56 |
| | **Telex Computer Products** | 28 |
| ■ | **Teradyne Incorporated** | 12-13 |
| ■ | **Texas Instruments Semiconductor** | 33 |
| ■ | **Texas Instruments Inc.** | 52-53 |
| | **Texas Instruments Mat & Cont.** | 43 |
| ■ | **Vactec Incorporated** | 91 |
| * | **Wandel & Goltermann** | 7 |
| ■ | **Zymos** | 36 |

## Classified and employment advertising

| | |
|---|---|
| **Hayes Micro Computer** | 62 |
| **TRW Defense Systems Group** | 101 |

■ For more information of complete product line see advertisement in the latest Electronics Buyers Guide
* Advertisers in International
‡ Advertisers in domestic edition

## dvertising Sales Staff

**tlanta, Ga. 30319:** Maggie M. Dorvee
170 Ashford-Dunwoody Road N.E.
04] 252-0626
**oston, Mass. 02116:**
oanna Henderson
75 Boylston St.
17] 262-1160
**hicago, Ill. 60611**
etsy A. Otto [312] 751-3739
William J. Higgens III [312] 751-3738
45 North Michigan Avenue
**leveland, Ohio 44113:**
312] 751-3738
**osta Mesa, Calif. 92626:** Larry Goldstein
001 Red Hill Ave. Bldg. #1 Suite 222
714] 557-6292

**allas, Texas 75240:** Harry B. Doyle, Jr.
151 Belt Line Road, Suite 907
214] 458-2400
**nglewood, Co. 80112:** Harry B. Doyle, Jr.
7400 South Alton Court Suite 111
303] 740-4633
**ouston, Texas 77040:** Harry B. Doyle, Jr.
7600 West Tidwell, Suite 500
[713] 462-0757
**Los Angeles, Calif. 90010:** Chuck Crowe
3333 Wilshire Blvd.
[213] 480-5210
or [213] 480-5203
**New York, N.Y. 10020**
Matthew T. Reseska [212] 512-3617
Albert J. Liedel [212] 512-3616
1221 Avenue of the Americas
**Palo Alto, Calif. 94303:**
Larry Goldstein, Lauren Scott, Lynne Simonfy
1000 Elwell Court, [415] 968-0280
**Philadelphia, Pa. 19102:** Joseph Milroy
Three Parkway, [215] 496-3800
**Pittsburgh, Pa. 15222:** Joseph Milroy
Suite 215, 6 Gateway Center, [215] 496-3800
**Southfield, Michigan 48075:** Betsy A. Otto
4000 Town Center, Suite 770, Tower 2
[313] 352-9760
**San Francisco, Calif. 94111:**
Larry Goldstein, Lauren Scott, Lynne Simonfy
425 Battery Street
[415] 362-4600

**Brussels:** Art Scheffer
23 Chaussee de Wavre
Brussels 1040, Belgium
Tel: 513-73-95
**Frankfurt/Main:** Fritz Krusebecker, Dieter Rothenbach
19 Liebigstrasse, Germany
Tel: 72-01-81
**Milan:** Savio Pesavento
1 via Baracchini, Italy
Tel: 86-90-656
**Paris:** Jean - Christian Acis
17 Rue-Georges Bizet, 75116 Paris, France
Tel: 720-33-42
**Scandinavia:** Andrew Karnig
Finnbodavagen
S-131 31 Nacka
Sweden
Tel. 46-8-440005
Telex: 17951 AKA S
**Tokyo:** Akio Saijo
McGraw-Hill Publications Overseas Corporation,
Kasumigaseki Building 2-5, 3-chome,
Kasumigaseki, Chiyoda-Ku, Tokyo, Japan
[581] 9811

**United Kingdom:** Art Scheffer
34 Dover Street, London W1
Tel: 01-493-1451

## Business Department

**Frederick J. Kostbar**
Business Manager/Controller
[212] 512-2627
**Leon Irgang**
Circulation Manager
[609] 426-5542
**Hugh Donlan**
Manager Circ./Direct Marketing
[609] 426-5541
**Archie Anderson**
Director of Marketing Services
[212] 512-6642
**Margery D. Sholes**
Research Manager
[212] 512-3191
**Frances M. Vallone**
Marketing Administration Manager
and Reader Service
[212] 512-6058
**Thomas M. Egan**
Production Director
[212] 512-3140
**Carol Gallagher**
Production Manager
[212] 512-2045
**Betty Preis**
Production Manager Domestic
[212] 512-2908
**Evelyn Dillon**
Production Manager Related Products
[212] 512-2044

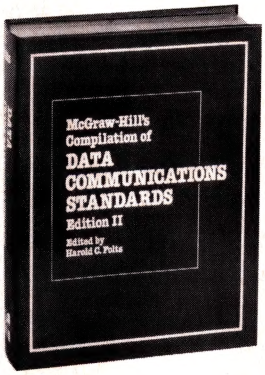
## Classified and Employment Advertising

[212] 512-2556

**NEW EDITION**

Complete and Unabridged
American and International

**DATA
COMMUNICATIONS
STANDARDS**



**All standards
are new, revised,
or reaffirmed
since the
previous edition**

1,923 pages
illustrated
Edited by Harold C. Folts

**Presents all 123 interface protocol standards set by:**
● International Telegraph and Telephone Consultative Committee (CCITT) ● International Organization for Standardization (ISO) ● European Computer Manufacturers Association (ECMA) ● American National Standards Institute (ANSI) ● Electronic Industries Association (EIA) ● U.S. Government (NBS and NCS)

**Special feature for instant access:**
Cross-reference tables of the standards of each group corresponding to those published by the others.

An essential reference for all who are exploring, planning, developing, manufacturing, or using data communications equipment or networks.

*Return Coupon to:*
*Data Communications Standards II*
**Electronics Week Books**
McGraw-Hill Inc.
Princeton Road
Hightstown, N.J. 08520
(Tel.) 609/426-5070

Send me ________ copy (copies) of **DATA COMMUNICATIONS STANDARDS EDITION II** at $250. U.S. orders please add local tax. McGraw-Hill pays regular shipping and handling charges on prepaid orders. Ten-day money-back guarantee applies.

☐ Check enclosed ☐ Bill me ☐ Bill company
☐ Company Purchase Order enclosed.

☐ American Express ☐ Visa ☐ MasterCard
___________ Interbank No.
Credit Card No. ________________ Expiration Date ______

Name ________________
Title ________________
Company ________________
Address ________________
City ________________
State/Zip (U.S.) ________________
Country (outside U.S.) ________________

ELV

# WHICH ONE COMES FIRST, SCIENCE OR ENGINEERING?

For years, we have excoriated those scientific leaders who hold with the old view that their role in the scheme of discovery is far more important than that of the engineers, the plodding technologists. It is as though these scientists see themselves as the occupants of a special spot high on the mountain of thought and deduction, while engineers labor below.

Lately, however, there has emerged a school of inquiry among those who study and teach the history of science and technology that reverses the common view of instrumentation and other engineering systems as merely passive tools. This view is that scientific discovery has been made possible through better techniques and tools, rather than only through the efforts of scientists generating ideas. As the chemist Thomas Graham wrote early in the 19th century, "It is curious how much the progress of science depends upon the invention and improvement of instruments."

A leader in that direction was the late science historian Derek J. deSolla Price, of Yale University, who maintained that the big 17th century breakthrough came not when Galileo looked at the heavens through his telescope, but when eyeglass makers took advantage of improved lens-making techniques to build the first telescope. In fact, Price went so far as to say that technology was the root of all scientific discovery.

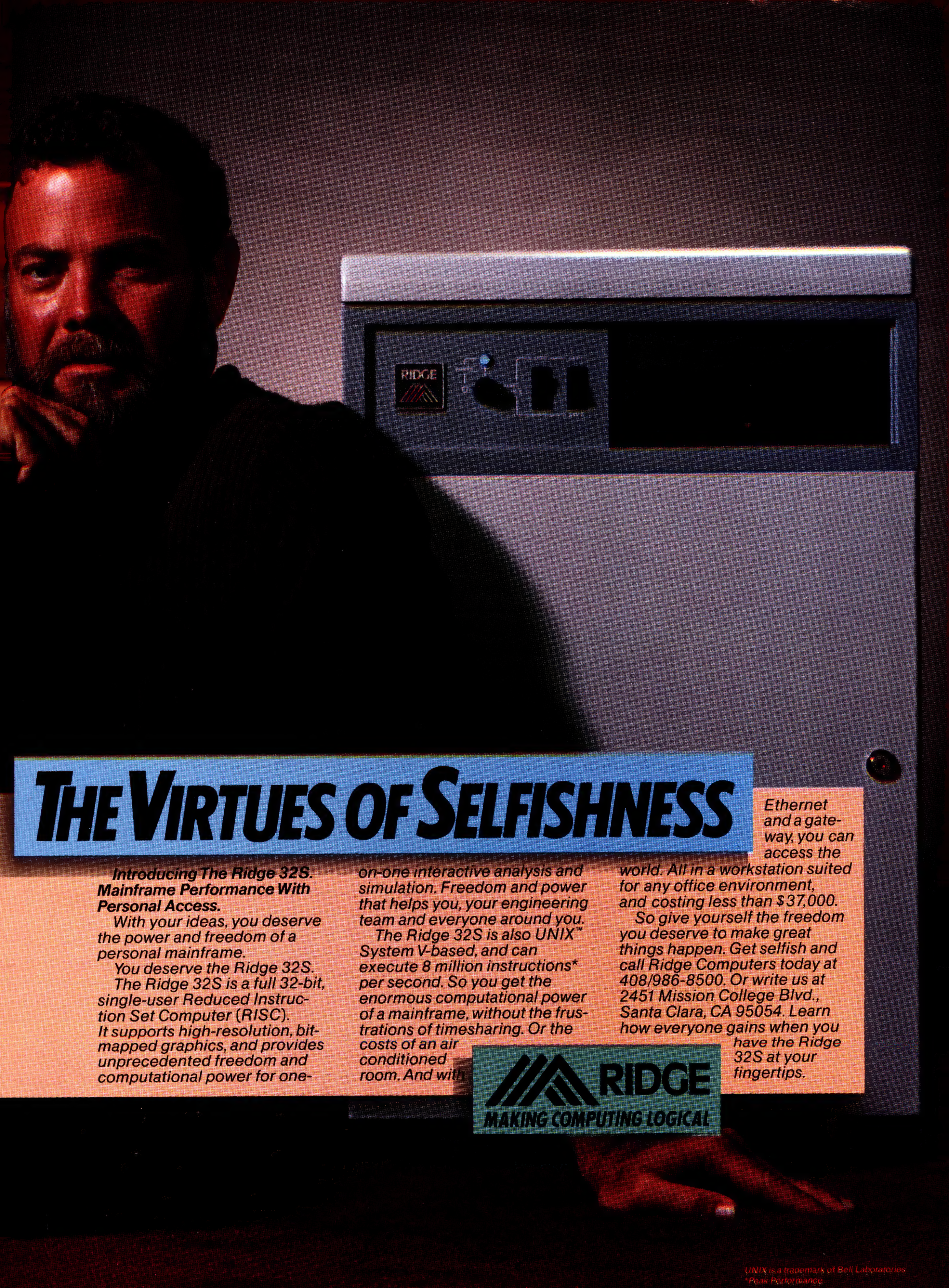
Price is not alone. Others have boarded the pro-technology bandwagon. One such is Melvin Kranzberg, a professor of the history of technology at Georgia Tech, who says, "Why are physicists always lined up at a new atom smasher? Because they want to be the first to investigate a new realm." Also, he says, "the great advances in science are based on measurements, refined technology, and new techniques. You see the impact all around us."

This debate takes on more significance than just another one of those interesting, if vaguely irrelevant campus disputes that liven up the days of some academic scientists, especially when considered against the background of all-important federal funding, and how best to spend billions of dollars to spur innovative research. In other words, should the university research facilities be the major beneficiaries, or should the engineering disciplines get more from the government than in the past?

Even though Price might have been overstating his argument to make a stronger case, as some of his peers suggest, his point is well taken. Those who dispense the money should not permit themselves to be swayed by impressive academic credentials or even by the need of university laboratories for research funds to keep themselves going—such support, vital as it is, is another question for another time.

At issue here is discovery. It is probably true that discoveries will be made regardless of whether scientists or engineers prepare the experiments and analyze data from such projects as the Space Telescope or the space shuttle. Nonetheless, let it not be forgotten that the computers, lasers, and other tools of exploration have been honed to their present fine edge by the engineers. And let engineering not be forgotten as a discipline at least on the same level as the sciences that benefit from it.

To find evidence that such recognition is coming to the world's technicians, albeit slowly, dip again into academia for this statement from Barry Barnes, a historian at the University of Edinburgh, in Scotland. "We are much less prone to think in terms which subordinate technology to science," he says. "Instead we recognize science and technology to be on a par with each other." Let's spread the word.



# THE VIRTUES OF SELFISHNESS

***Introducing The Ridge 32S. Mainframe Performance With Personal Access.***

*With your ideas, you deserve the power and freedom of a personal mainframe.*

*You deserve the Ridge 32S.*

*The Ridge 32S is a full 32-bit, single-user Reduced Instruction Set Computer (RISC). It supports high-resolution, bit-mapped graphics, and provides unprecedented freedom and computational power for one-on-one interactive analysis and simulation. Freedom and power that helps you, your engineering team and everyone around you.*

*The Ridge 32S is also UNIX™ System V-based, and can execute 8 million instructions* per second. So you get the enormous computational power of a mainframe, without the frustrations of timesharing. Or the costs of an air conditioned room. And with Ethernet and a gateway, you can access the world. All in a workstation suited for any office environment, and costing less than $37,000.*

*So give yourself the freedom you deserve to make great things happen. Get selfish and call Ridge Computers today at 408/986-8500. Or write us at 2451 Mission College Blvd., Santa Clara, CA 95054. Learn how everyone gains when you have the Ridge 32S at your fingertips.*

**RIDGE**

**MAKING COMPUTING LOGICAL**

UNIX is a trademark of Bell Laboratories
*Peak Performance

Circle 901 on reader service card

local distributor
with 49 locations
stocking the finest
lines of electronic
components and
computer products

| | |
|---|---|
| **ALABAMA** | |
| Huntsville | (205) 837-7210 |
| **ARIZONA** | |
| Phoenix | (602) 231-5100 |
| **CALIFORNIA** | |
| Avnet, L.A. | (213) 558-2345 |
| Avnet, S.F.V. | (818) 700-2600 |
| Avnet, O.C. | (714) 754-6111 |
| Hamilton, L.A. | (213) 558-2121 |
| Hamilton, S.F.V. | (213) 558-2323 |
| Hamilton, O.C. | (714) 641-4100 |
| Sacramento | (916) 925-2216 |
| San Diego | (619) 571-7510 |
| San Francisco | (408) 743-3355 |
| San Gabriel | (714) 989-4602 |
| **COLORADO** | |
| Denver | (303) 779-9998 |
| **CONNECTICUT** | |
| Danbury | (203) 797-2800 |
| **FLORIDA** | |
| St. Petersburg | (813) 576-3930 |
| Miami | (305) 971-2900 |
| Orlando | (305) 628-3888 |
| Melbourne | (305) 725-2700 |
| **GEORGIA** | |
| Atlanta | (404) 447-7507 |
| **ILLINOIS** | |
| Champaign/ Urbana | (800) 625-8654 |
| Chicago | (312) 860-7700 |
| **INDIANA** | |
| Indianapolis | (317) 844-9333 |
| **KANSAS** | |
| Kansas City | (913) 888-8900 |
| Wichita | (800) 532-6720 |
| **KENTUCKY** | |
| Louisville | (800) 428-6012 |
| Lexington | (800) 543-4783 |
| **MARYLAND** | |
| Baltimore | (301) 995-3500 |
| **MASSACHUSETTS** | |
| Boston | (617) 273-7500 |
| **MICHIGAN** | |
| Detroit | (313) 522-4700 |
| Grand Rapids | (616) 243-8805 |
| **MINNESOTA** | |
| Minneapolis | (612) 932-0600 |
| **MISSOURI** | |
| St. Louis | (314) 344-1200 |
| **NEBRASKA** | |
| Lincoln/Omaha | (800) 255-6702 |
| **NEW JERSEY** | |
| Fairfield | (201) 575-3390 |
| Cherry Hill | (609) 424-0100 |
| **NEW MEXICO** | |
| Albuquerque | (505) 765-1500 |
| **NEW YORK** | |
| Long Island | (516) 231-9800 |
| Syracuse | (315) 437-2641 |
| Rochester | (716) 475-9130 |
| **NORTH CAROLINA** | |
| Raleigh | (919) 878-0810 |
| **OHIO** | |
| Cleveland | (216) 831-3500 |
| Columbus | (614) 882-7004 |
| Dayton | (513) 433-0610 |
| **OREGON** | |
| Portland | (503) 635-8831 |
| **PENNSYLVANIA** | |
| Philadelphia | (215) 831-1300 |
| Pittsburgh | (800) 321-6890 |
| **SOUTH CAROLINA** | |
| Columbia | (800) 334-1597 |
| **TEXAS** | |
| Dallas | (214) 659-4111 |
| Houston | (713) 780-1771 |
| Austin | (512) 837-8911 |
| **UTAH** | |
| Salt Lake City | (801) 972-2800 |
| **WASHINGTON** | |
| Seattle | (206) 453-5844 |
| **WEST VIRGINIA** | |
| Charleston | (800) 543-4783 |
| Huntington | (800) 543-4783 |
| **WISCONSIN** | |
| Milwaukee | (414) 784-4510 |
| **INTERNATIONAL EXPORT** | |
| Los Angeles | (213) 558-2441 |
| New York | (516) 997-6868 |
| Telex | 66-4329 |
| **CANADA** | |
| Toronto | (416) 677-7432 |
| Montreal | (514) 335-1000 |
| Ottawa | (613) 226-1700 |
| Calgary | (403) 230-3586 |
| Vancouver | (604) 272-4242 |
| **JAPAN** | |
| Tokyo | (03) 662-9911 |

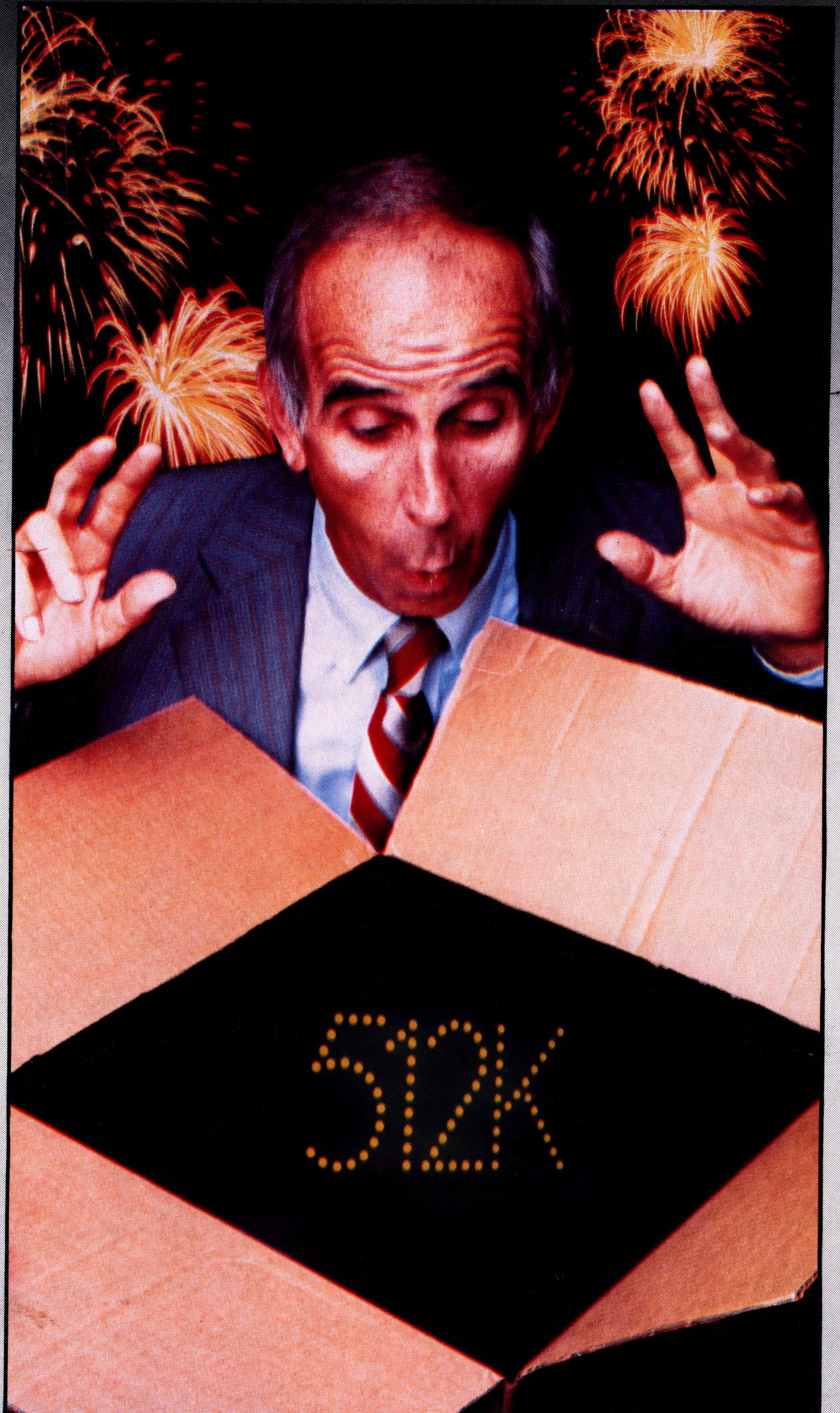
Hamilton Avnet

85

FOCUS ON SERVICE

# THE CELEBRATED 512K

# DELIVERED!



## HAMILTON/A
## BRINGS YOU
## EXCITEMENT

The Am27512 fro
Advanced Micro De
has sparked quite a
celebration—and n
we're bringing all th
excitement right to
door. It's the first E
anywhere with 512K
capacity—enough t
an entire operating
tem. And it's already
production, with de
through Hamilton/A

But there's even n
celebrate. Because
all five devices in AM
EPROM family are
in military versions.
includes the Am272
world's fastest 256K
EPROM (with 200 n
access speed in the
itary version, and 17
access speed in the
mercial version). Yo
also take your pick
itary or commercial
of AMD's Am27128 (
Am2764 (64K) and
Am2732A (32K), as
the Am27512.

They're all availab
through your nearby
Hamilton/Avnet loca
We've been the best
source for AMD sen
ductors since this dy
company began. As
new product has be
introduced, we've ma
available to you as q
as possible. AMD's
Am27512 and the ne
tary versions of the E
line are no exceptio

Hamilton Av
ELECTRONICS

A commitment to sto
serve your local ma

Circle 902 on reader service

**Am27512 EPROM from ADVANCED MICRO DEVI**
**ADVANCED MICRO DEVICES from HAMILTON/AVN**